“Social Security Coverage in Chile, 1990-2001”

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Abstract: This empirical paper identifies the main forces that influenced the coverage of the new Chilean pension system during the 1990s. I find that government policy determined coverage to a large extent. The key policies in this respect in order of importance were: the level of the Minimum Salary, the level of the flat commission charged by pension fund managers, the rate of economic growth, and the size of subsidies given to workers when they use state hospitals. If the governments of Chile in the 1990s had used these policy levers in a range of different ways, then contributors as of August 2001 could have been anywhere between 3.3 and 4.3 million workers. My second finding - from non econometric evidence - is that the Minimum Salary applies to reported earnings rather than actual earnings. Thus, increasing the Minimum Salary does not appear to reduce coverage by inducing formal-sector employers to fire low productivity workers but does so by forcing poor workers to save more for old age and by reducing the amount of Minimum Pension subsidy that they can expect. The third result is that the net impact of raising the Minimum Pension floor is not statistically different from zero. To explain this I present a simple model that shows that an increase in the level of the Minimum Pension floor has two effects on coverage, of opposing signs, so the net impact is uncertain.

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I: Introduction

In any contributory pension plan, if workers’ careers in jobs that are covered by the plan are interrupted or if they have periods of unemployment throughout their working lives, then the pensions that they will receive in their old age will be reduced. A reduction in the protection offered by the plan implies that it may not fulfill the aim of alleviating improvidence among workers of most income levels. This outcome has at least two implications for pension policy. First, the mandate to contribute may not be yielding enough benefits to alleviate improvidence compared to the inefficiencies and social costs that the mandate also creates, thus threatening the social and political legitimacy of the pension scheme. Second, when contributory pensions are low, this builds political support for increasing fiscal expenditures on first-pillar programs to top up the mandated second-pillar pension, which raises fears that the government’s budget will be over-stretched. To a large extent, the validity of these concerns depends on how great the problem is in practice. Therefore, it is important to pin down empirically the factors that generate significant changes in coverage.

According to the literature, a number of factors affect the coverage of contributory pension plans: (i) the design and performance of the pension plans; (ii) demographic and labor market factors; (iii) economic growth and macroeconomic conditions; and (iv) labor policy and other policy factors. The influence of the latter three factors is nowhere more evident than in Chile, a country where pension policy was thoroughly reformed in 1981. Nevertheless, contributory pension plans in Chile had only modest and constant coverage rates during the 1990s, not much higher than the rates that prevailed before the 1981 reform.

As the time period that I analyze – 1990 to 2001 – does not include 1981, the year when Chile introduced funded mandatory and privately-managed pensions, this paper cannot shed much light on the impact of that reform on coverage by itself. On the other hand, this time period is particularly suitable for identifying and quantifying the impact of economic growth, changes in Minimum Salaries and changes in the magnitudes of the first pillar, on coverage. This may be of interest to policymakers in countries that have already adopted substantial pension reforms but who are dissatisfied with current coverage levels.

My main finding is that economic policies, other than pension policy, have a substantial influence on coverage. It is frequently the case that labor and social legislation that is not related to pensions, such as minimum wages, mandatory severance payments, collective bargaining rules, and mandates to provide health insurance (or to contribute to it) are imposed on the same workers who are covered by mandatory old age pension plans. Thus, changes in labor and social legislation that impose costs and benefits on these aspects of participation in covered labor markets may induce some workers to leave or join these markets, which will also affect the coverage of the pension plan. In this paper, I find that these influences are indeed substantial. In other words, government policy largely governs coverage of pensions, even when pension policy itself remains unchanged.

1 Anecdotal evidence suggests that the pension reforms in Bolivia and El Salvador has succeeded in expanding coverage in those countries. This has been confirmed by a country panel study that estimates the impact of pension policy (see Packard, 2001), which is another background paper for the regional study).
The main policy levers in this respect in order of importance were: the level of the Minimum Salary, the level of the flat commission charged by pension fund managers, the rate of economic growth, and the size of subsidies given to workers in the covered sector when they use state hospitals. If the governments of Chile in the 1990s had used these policy levers in a range of different ways, then contributors as of August 2001 could have been anywhere between 3.3 and 4.3 million workers. (The size of this range is 26 percent of the midpoint.)

Regarding pension policy, neither the level of wage-based pension fund commissions nor the financial performance of pension funds influenced coverage from 1990 to 2001. The only aspect of pension policy that influenced coverage was the size of the flat commission charged by pension fund managers; I found that a higher flat commission reduces coverage. This may be because it discourages self-employed and economically inactive people who may be considering entering the covered sector from doing so. I define flat commissions as a “policy” lever for two reasons. First, the law may cap the flat commission charged by pension fund managers for equity reasons, as happens in several Latin American countries who cap it at zero. Second, in some countries, the authorities influence the level of commissions by bilateral bargaining with a tight oligopoly of pension fund managers.

One important finding is that the Minimum Salary seems to influence reported earnings rather than actual earnings. Non econometric evidence suggests that the Minimum Salary does not reduce coverage by forcing low productivity workers out of formal employment, as is usually thought, because its level has been below average earnings in the informal sector. This implies that an increase in the Minimum Salary reduces coverage in a way that has previously been unnoticed in the literature; the contributions of those who declare that they earn only the Minimum Salary must increase when the Minimum Salary rises. An increase in the Minimum Salary reduces underreporting of earnings, forcing poor workers to save larger amounts for their old age.

The impact of an increase of the Minimum Salary on coverage among poorer workers who expect to become entitled to the first pillar (Minimum Pension) subsidy, is even stronger. This subsidy is targeted to members whose self-financed pension is below a threshold called “legislated pension floor.” The amount of this subsidy is the difference between the pension floor and the self-financed pension. According to this design, higher contributions reduce the amount of Minimum Pension subsidy dollar per dollar, on a present value basis, so a worker does not benefit from any increases in the contribution amount driven by an increase in the Minimum Salary, even if he does not care about low liquidity and high commissions. For poor workers, the full contribution is a tax, which means that any increase will cause the number of poor workers who are covered to decline. Thus, an increase in the Minimum Salary increases forced savings and reduces coverage among the poor.

The size of the legislated pension floor may have a separate impact on coverage, unrelated to the size of the Minimum Salary. Part III presents a simple model of the impact of raising the legislated Pension floor and finds that this has two effects on coverage, of opposing signs. A negative effect, which has not previously been considered, is that an increase in the size of the pension floor raises the probability that a worker will become entitled to the Minimum Pension subsidy. This reduces the expected contribution-benefit linkage because, in those circumstances in which the member is entitled to the Minimum Pension, his or her further contributions benefit the government (taxpayers) and do not increase pension amounts at all. An expected
contribution-benefit linkage of this size (zero) induces some workers to spend more of their time working in the uncovered sector or in inactivity, which thus induces a reduction in coverage. Thus, I was not surprised by the empirical finding for my sample period that an increase in the level of the legislated Pension floor has a net impact on coverage that is not statistically different from zero.

These findings appear to be applicable to all countries whose labor markets have informal sectors of comparable sizes to the informal sector in Chile. The conditions for applicability are, first, that the tax authorities cannot observe the true income of the self-employed with low error margins, so these workers are effectively or legally free to contribute to “mandatory” pension plans. The second condition is that the employer-worker axis retains the ability to underreport a substantial portion of labor payments from the tax and pension authorities, thus creating the situation that I have described as “partial informality.” To my knowledge, most Latin American and newly industrialized East Asian and South Asian countries meet these two conditions. On the other hand, the countries of Western Europe, Japan, the United States, Canada, Australia, and New Zealand do not. Because my empirical results regarding coverage are similar whether I include or exclude the old Chilean pension plan, I believe that my findings are valid regardless of the form taken by the mandatory plans.

In Part II, I justify my definition of coverage. In Part III, I review the ways in which pension policy influences coverage and define the pension policy variables that I used in my empirical work. In Part IV, I review the ways in which demography, economic growth, macroeconomic conditions, labor policies, and health policies affect coverage. Part V describes the data, the equations to be estimated, and the empirical results. Part VI gives the implications of my findings for government policy.

II: The Definition of Coverage

The precise definition of coverage has important consequences for this empirical work. In the case of Chile, the self-employed (“independientes”) are legally exempt from the mandate to contribute to all Chilean second-pillar plans. These workers are allowed to contribute to AFP plans (Administradoras de Fondos de Pensiones, i.e. pension fund management companies and the law-designed plans they offer) on a voluntary basis, as in third-pillar plans, but only 4.2 percent of them do so in any given month. As self-employed workers have comprised 30 percent of total Chilean employment for the last three decades (Arenas, 2000), this exemption marks a considerable difference from the situation in most OECD countries. I do not favor measuring coverage as the ratio between the number of non-pensioned plan members (active affiliates who are not yet old enough to be receiving the pension) and some measure of the workforce. The number of non-pensioned plan

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2 It is a traditional state-managed, pay-as-you-go financed, defined benefit plan subject to discretionary legislation. It uses a years-of-service benefit formula that integrates a minimum pension.
3 This number is expected to increase starting in 2002, because new reforms enacted in 2001 increased dramatically the liquidity of voluntary third-pillar savings in Chile and thus their value to savers.
4 This exemption may or may not be socially desirable. I submit that the exemption is desirable if the value of mandating improvident workers to save is smaller than the cost of the distortions that would occur and the administrative expenses that would be involved if the self-employed were required to contribute.
members includes everybody who has contributed at least once at some time in the past, except those who have started to receive a pension. Therefore, the numerator of this ratio is a sort of sum over time of the number of past contributions, which is a variable that moves slowly. It does not have a clear interpretation either, because it includes those who currently work at home but who contributed in the past and those among the self-employed who have contributed in the past. The fact that this ratio is way above 100 percent in Chile\(^5\) shows that it cannot be used to measure coverage.

Another option is to define coverage as the ratio of contributors to “dependent” workers (dependency means that the worker grants the employer the right to direct his or her activities, within certain limits\(^6\)) because Chilean laws mandate contributions on dependent workers only. On the basis of monthly data, this ratio has been close to 80 percent in Chile since 1986.\(^7\) For international comparison, this figure must be adjusted upwards due to the fact that the Chilean data are given on a monthly rather than an annual basis. This is because, in most traditional state-run plans, coverage is measured as the number of people who contributed at least once during the previous calendar year divided by total employment. In the U.S., this ratio is routinely above 1 (closer to 110 percent) due to flows to and from inactivity and unemployment within the year. The difference between these two frequencies is large, as shown by the Chilean data. As of June 1996, there were 2.6 million contributors to the Chilean AFP, and 3.7 million members had contributed at least once in the preceding 12 months.\(^8\) The implied adjustment factor is 1.42, pushing the adjusted coverage rate to 0.80x1.42 = 114 percent, which is close to the comparable U.S. figure. The absence of this adjustment may bias the results of international panel studies.

However, if one defines coverage as the ratio of contributors to “dependent” workers in any given month, the ratio may rise even though the number of contributors falls if the number of “dependent” workers in the denominator falls faster. The same problem arises when coverage is defined as the ratio of contributors to total employment (as done by Arenas, 2000), because that indicator may rise just because employment falls faster than contributors. To obtain results that are more robust and economically significant, I chose a denominator that is exogenous. I find that the best denominator is the population aged 15 years or older.\(^9\)

A final issue is the choice between two available measures of contributors to the AFP plans. In the official data, “total” contributors include contributions accrued in previous months that were paid in the month in question. The number of “current month” contributors is smaller by about 10 percent because it excludes contributions accrued in previous months and paid in the month in question. In supplementary regressions, I found that the lag from accrual to payment is endogenous to economic

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\(^5\) In the case of Chile, the sum of affiliates to the AFP plan plus some 200,000 contributors to the INP plans is currently 116 percent of all dependent employees (in the formal sector). The number of affiliates should be increased by an unknown number of non-pensioned members of the INP plans who are not currently contributing.

\(^6\) Compensation with piece-rates, i.e. per unit of output, usually implies that the employer does not direct the worker’s labor input, so such workers would not be dependent.

\(^7\) See Table 3.8 in Chamorro, 1992, p. 86.

\(^8\) See Superintendencia de AFP de Chile, Bulletin 134, page 70.

\(^9\) Changes in the real wages of women may affect fertility rates, but the effects are felt in the labor market at least 15 years later and our sample is only 11 years long. In addition, migration to and from Chile is very limited. For these reasons, we think it is safe to take the population path as exogenous in our sample.
factors. I chose as the dependent variable the number of “total” contributors because it is more predictable.

In my sample period, the average coverage rate defined in this way is 28.7 percent for the AFP plans and 32.1 percent for the AFP and INP plans combined. (The INP (Instituto de Normalización Previsional) is the unit that runs Chile’s old system.) This means that, in an average month, 67.9 percent of the population above the age of 15 was inactive (out of the labor market), was active and exempt from contributing, or was evading contributions.

III: Pension Policy and Coverage

The theoretical literature on pension policy shows that a number of aspects of the design of a pension plan can have an impact on coverage. This section reviews the following aspects of pension policy: the size of the contribution rate, the strength of the benefit-contribution linkage in the benefit formula of the plan, the efficiency of collection risk allocation, the size and nature of subsidies offered by first-pillar pension programs, and the financing method used by the plan. After reviewing each item, I discuss its applicability to our Chilean sample.

The reader is advised that this review identifies 10 pension policy variables that may have an impact on coverage. However, in the empirical part, I find that only one of them had a significant influence on coverage in the long run in my sample. The other variables did not change during this time, had only a short-term influence, or simply turned out not to have any significant influence. Still, economists analyzing other time periods or other countries should probably consider all of these variables.

The Size of the Contribution Rate

When improvident workers perceive a mandate to save for old age as excessive compared to the amount that they wish to save voluntarily, they will see an increase in the size of the total contribution rate (combining the components paid by workers and employers) as an increased tax on filling jobs covered by the plan and as an increased tax on increasing the number of hours covered by the plan. As a result, coverage is likely to decline. This reduction would be is proportional to the size of the wage

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10 For example, the onset of a contraction in macroeconomic activity induces an increase in contributions accrued but not paid, so current month contributions grow faster than total contributions. In addition, since late 1999 a new law has dictated that a dismissal notice to a permanent worker does not have the effect of firing her unless the employer can show that it has paid her accrued contributions (Law 19.631, published in the Official Register September 28, 1999). This new requirement holds if the dismissal occurs under article 161 of the Labor Code (the motive of dismissal is the employer’s needs) or articles 159 and 160 under additional conditions but does not hold for dismissals made under any other articles.

11 The correct way of combining the contribution rate of the employer (θE) and of the worker (θL) is to express the sum as a proportion of total employer costs. If health and other contributions paid by the employer occurs at rate γE, then the total will be: θ_{\text{total}} = (θE + θL)/(1 + θE + γE). None of these rates changed in Chile in our sample.

12 This result is compatible with the possibility that later on in their lives these same workers will be grateful to society for forcing them to save for old age when they come to realize that they were improvident when young.
elasticity of the supply of labor to the covered sector.\textsuperscript{13} This prediction is equally valid when the contribution is made in the name of the employer rather than of the worker, because employers react to increases in their costs by reducing their demand for labor. In this case, the labor market also equilibrates at a lower level of coverage and at lower wage rates.\textsuperscript{14}

This result also applies when workers receive the minimum wage rate as set by labor legislation. For example, when all of the contribution is made by the employer in the worker’s name, workers will see any increase in the total contribution rate as an increase in the benefits that accrue to themselves and, thus, will expand their supply of labor. Employers on the other hand will see it as an increase in their costs and will reduce the quantity of labor that they demand. As long as workers perceive that a portion of the contribution does not benefit them, then coverage will fall. This point is expanded below.

During the sample period in Chile, the statutory contribution rate did not change,\textsuperscript{15} nor did its distribution between employers and contributors (100 percent is paid by contributors). Therefore, this impact is a part of the constant term in my regressions.

However, other factors that make workers perceive mandatory contributions as less desirable than voluntary saving did change in our sample. They include the level of AFP commissions and of employers’ administrative costs, awareness among workers of the likelihood of living into old age, the illiquidity of pension savings, trust in the promises made by pension plan administrators, and education levels.

\textit{Flat Commissions.} Flat commissions (a flat $ amount per contribution) is charged by the managers on the balance of contributors’ individual accounts. These commissions reduce pensions but do not reduce workers’ take-home wages. Therefore, I expect flat commissions to reduce the coverage of those workers who do not expect to receive the Minimum Pension subsidy, possibly because they do not expect to meet the 20-year contribution requirement (which is explained below). However, for those workers who expect to receive the Minimum Pension subsidy, the size of the flat commission should be irrelevant because it merely increases the fiscal cost of this subsidy but does not reduce the worker’s pension. Thus, I expected the average level of flat commissions to have had a negative influence on coverage that was proportional to the fraction of potential contributors who expected not to receive the Minimum Pension subsidy. It should be noted that the flat commission is by far the most well known and transparent of AFP commissions in Chile, and the press and politicians have been raising the issue of its regresiveness repeatedly since 1981.

\textit{Wage-based Commissions.} Wage-based commissions (a set percentage of reported earnings) are added to the contribution rate in Chile and thus reduce take-home

\textsuperscript{13} We assume that the demand for labor in the covered sector is always elastic due to substitution for physical capital.

\textsuperscript{14} Both contract wages and take-home wages equilibrate at a smaller level. I designate as the “contract wage” the wage rate specified in the labor contract, which is the base used to calculate both the employer’s and the employee’s contributions.

\textsuperscript{15} However, I show in Part III below that the effective contribution rate may have changed as the minimum salary changed.
wages but not the balance of contributors’ individual accounts, nor pensions. However, workers may not notice this earning deduction as only the total monthly contribution is reported in the employer receipt every month. The account statements sent by each AFP to its members every four months report the wage-based commission amount of each of the past four months, not the annual projected charge. Another factor that makes this commission difficult to perceive is that its exact amount changes every month as overtime and other components of earnings fluctuate, and other deductions can also obscure its existence. If it has any effect at all, increasing the level of wage-base commissions is likely to reduce coverage.

As the wage-based commission is a rate and as people care about income rather than the rates themselves, this variable must be multiplied by some monthly wage. This could be average reported earnings or the Minimum Salary. If participation in a mandatory pension plan is unavoidable for most average earners, then wage-based commissions is likely to have a very small effect on coverage among workers with average earnings. If workers who earn low salaries in the formal sector are close to becoming self-employed, then wage-based commissions may cause their coverage to decline more steeply. After testing both specifications, I found that the second one performs somewhat better, although both are statistically insignificant.

**Administrative Costs.** The administrative costs incurred by employers in complying with mandatory contributions may have changed over the sample period due to the rotation of AFP plan members among different fund management companies, known as “churning.” When this happens, employers can often become confused about which fund management company they need to pay the contributions of their workers. This may create a greater administrative load for employers in the covered sector. Because this load is proportional to the number of workers hired by the firm, the employer may be prompted to lay off some workers. As an indicator of this cost, I chose the ratio of the number of transfers of workers’ accounts among fund management companies and the number of contributors.

**Average Age.** Evidence from the United Kingdom suggests that the closer a worker gets to retirement, the more aware he or she becomes of the need to save for old age and the less improvident he or she becomes (Banks et al, 1998). Thus, an increase in the average age of contributors, which did occur during our sample period, can be expected to reduce improvidence, and this is turn should increase coverage. Therefore, I added average age of contributors as an explanatory variable for coverage.

The literature on awareness of old age has used various other variables. Corsetti and Schmidt-Hebbel (1997, p. 147-8 and 150) suggested that awareness of old age would increase (and improvidence would fall) as members received regular statements of their pension fund savings in AFP plans. The authors provided some evidence that the average balance in individual accounts per worker (proxied by the ratio between pension funds and GDP) had a positive impact on voluntary saving in Chile for a sample with annual data from 1960 to 1992.

However, the correlation between the size of AFP account balances and the receipt of regular statements may be very low. If one speculates that the higher the balances, the more likely they are to impress members, then the pension account balances to be compared with GDP should include the recognition bonds, which are
reported in the statements for AFP plan members, plus the expected present value of accrued pension rights under the old INP for those members who are close to pension age.

Moreover, this interpretation of an average balance variable is not appropriate when average age is also present in the regression, as in our case. The average account balance in an immature plan (as the Chilean AFP plan was during the 1990s) grows with age as it gradually accumulates interest and new contributions. Given an increase in the age of the plan members, which implies that the balance in their individual accounts also increases, the coefficient of the average balance variable would only tell us about the impact of any deviation between actual and expected balances. For example, if this deviation is negative, workers may react by saving and working more hours. The point is that the impact of this deviation on their willingness to choose to work in covered jobs is uncertain. Thus, given that I already included an average age variable, I find no reason to add an average account balance variable.

The Phase of the Business Cycle. Mandatory savings are illiquid while voluntary savings are more accessible. By illiquidity, I mean that workers are not legally allowed to withdraw or mortgage their accumulated pension balance to finance any emergency needs, which is a genuine disadvantage even for provident workers. Although these legal rules did not change during between 1990 and 2001, the cost to workers of this illiquidity may have changed. It is likely that this disadvantage is most acute during times when unemployment is rising and more people are forced to draw on their relatives’ and friends’ financial support to survive. There were no large unemployment insurance programs nor publicly provided work subsidies in Chile during the sample period, so the family support network was critical, and access to credit was also important for families going through difficult financial times. Thus, I included an indicator of the phases of the business cycle in my regressions, in the assumption that this may have an influence on the cost of illiquidity and thus on coverage.

Workers’ Trust. For the system to be effective, workers have to trust that the pension plans will actually pay them the promised benefits. If there were good reasons for workers to believe that the benefit formula would be modified in the future to their detriment, even provident workers would start to see their contributions as a tax rather than as a deferred benefit. In Chile, the parties that opposed the government of General Pinochet (1973-1990) stated repeatedly that they would reverse the pension reform of 1981, at least partially, as soon as they came to power. As it became very likely after the 1988 referendum on the continuation of Pinochet as president, that the opposition parties would soon come to power, it seemed likely that some members might lose part of their accrued pension rights. However, when the first democratic government came to power in 1990, it opted for stability and ignored this campaign promise, focusing its reformist zeal on other issues such as some labor law reforms that will be discussed below.

We should also consider the endogeneity of the average account balance of contributors. If coverage increases, new self-employed contributors will have a zero or low account balance and will push the average account balance of contributors downward. Thus, changes in the average account balance of all contributors would be correlated with coverage because of changes in the set of contributors. In this sample, coverage did increase, so it looks as if this effect did operate.
Thus, I decided it would be useful to include an indicator variable that reflected workers’ trust in the likelihood of receiving their promised pension. If my regressions were to show that this variable was positive at the time of the reforms and fell exponentially to zero over time, this may reflect an increase in trust over the years as workers realized that their pension rights in the AFP were increasingly likely to be respected. Thus, I expected the impact of this variable on coverage to be negative. The regression would determine both the speed of this convergence to zero and the level of the indicator.

**Time Trends.** As time passes, people learn how to participate in second-pillar plans in such a way as to minimize the costs that it may impose on them. In addition, as time passes, more people learn how to minimize these costs as this information gradually spreads throughout the population. To capture this effect, I decided to add a time trend to the explanatory variables. My expectation was that, as time passes, coverage would increase as optimal adaptation reduces the extent to which the mandate is a burden on workers in the covered sector.

**The Strength of the Benefit-contribution Linkage**

When the benefit formula involves a promise to pay each member an increment to his benefits whose expected present value is below $1 for each additional $1 of contributions that he makes, then even provident workers may consider part of their contribution to be a pure tax. For example, if a covered individual works overtime, and pays additional contributions, and benefits increase by less than the contribution, the loss is a pure tax. As some workers may react to this tax by becoming self-employed or inactive, the size of the benefit-contribution linkage is a determinant of coverage. For a provident worker with no liquidity costs, this linkage depends on the benefit formula only.

The benefit formula of a pension plan is a function that specifies the level of promised benefits at the individual level. The variables that represent this function are the size and timing of personal contributions and of covered salaries. One important type of benefit formula is called “years of service” where the pension amount is a function of the number of years of contributions (“length of service”), the indexed average of past covered salaries, and fixed accrual factors. The other important type of benefit formula is called “actuarial,” of which the best known is “individual accounts.” In this type of formula, each member has an individual account into which his or her contributions and interest are credited, and a worker’s initial pension benefit is directly proportional to the balance of his or her account.

In Chile, the formula used in the INP is “years of service.” This formula has a low contribution-benefit linkage for most members except for two groups: (i) those who are in the last five years of their career and (ii) those who have not met the 10-year

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17 As future contributions and covered earnings are uncertain as of a given point in time and as the level of benefits promised by a formula is conditional on the actual values taken by those variables, the level of benefits is uncertain.

18 Deferred annuity formulae are also “actuarial,” but they operate with expected values rather than with individual accounts. For example, the members of an annuity group that die earlier than average, free up the funds needed to pay further pensions to those members of the group who live longer than average. If each member had a separate individual account, mutual insurance could not be provided.
service threshold. For these two groups, the linkage is excessive, in other words, above $1 in the present value of their additional benefits per $1 of their additional contributions.\textsuperscript{19,20} On the other hand, the AFP plan offers a contribution-benefit linkage of close to 1, although this is reduced by commissions charged by pension fund managers.

During the sample period I study, the benefit formulae for both the AFP and the INP systems stayed constant. This reduces to five the number of factors that may have influenced the overall benefit-contribution linkage during our sample period: (1) the relative size of the AFP and INP plans; (2) the relative number of INP plan members who perceived a high linkage because their current contributions entered the five-year earnings average or because they were close to meeting the 10-year service threshold; (3) the average level of commissions in the AFP plans, which reduces the contribution-benefit linkage\textsuperscript{21}; (4) the financial performance of the pension funds in the AFP system, which might have influenced the contribution-benefit linkage if it diverged significantly from the returns to be had from voluntary savings; and (5) the extent to which contributors suffered from liquidity constraints.

These factors – except for factor (2), which I omitted because there were no data available – can be represented by the following empirical counterparts: (i) an indicator of the share of AFP contributors in the total number of contributors to both the INP and the AFP; (ii) an indicator of the average level of flat commissions (a flat fee per contribution); (iii) an indicator of the average level of wage-based commissions; (iv) an indicator of the difference between the financial returns from pension funds and the financial returns offered by voluntary saving vehicles\textsuperscript{22}; and (v) an indicator of the phase of the business cycle interacted with the difference in financial returns to account for changes in liquidity.

**Efficiency of Collection Risk Allocation**

Employers will have an incentive to evade making their mandatory contributions on behalf of their workers when it is clear that they will suffer no sanction for failing to do so and that their workers will not suffer because their pensions are guaranteed by a third party. Consider a case where a third party (such as the government) guarantees the payment of the plan’s benefits, set according to a formula that excludes actual contributions received. If the employer declares bankruptcy, the government will pick up the bill. This allocation of collection risk creates conditions that facilitate collusion.

\textsuperscript{19} In the Servicio Seguro Social (SSS) plan, which serves 80 percent of private sector workers at the INP, the initial pension is calculated on the basis of the average of the worker’s last five years of wages. Therefore, the present value of pension increments obtained in exchange for a higher reported salary within those five years is higher than the cost of increasing the contribution. For this reason, a provident member has an incentive to bribe his employer to over-report his earnings.

\textsuperscript{20} In the Servicio Seguro Social (SSS) plan, the minimum service threshold is 10 years. A provident member who has not completed the 10-year threshold may be willing to invent a job and to contribute artificially in order to meet this threshold. He can also over-report his earnings.

\textsuperscript{21} It might be imagined that flat commissions, being fixed, do not reduce the marginal contribution-benefit link. However, Chilean law allows each AFP to charge flat commissions only in the months when the member contributes. Therefore, the expenses caused by this commission are not really fixed but a per-contribution charge.

\textsuperscript{22} I discuss below the need to adjust for investment risk raised by the fact that pension funds are mutual funds, which, unlike bank deposits, do not commit to any specific return.
between the employer and the worker to exploit the plan’s guarantee. For example, the improvident worker may be willing to cover up for the employer, because this reduces the effective contribution rate and turns the perceived tax into a subsidy. A minor paradox is that the coverage of pension benefits may increase in this situation (if the employer reports the necessary information about wages or accrued contributions giving the workers the right to claim benefits) even while coverage of contributions is simultaneously falling.\textsuperscript{23}

The contrary case would be where the plan pays benefits according to a formula that is a function of reported earnings or reported contributions but collection is the responsibility of an employer who guarantees the plan’s benefits. In this situation, an employer’s failure to remit the necessary contributions merely increases in the employer’s own liability towards the plan; thus, the employer will not be interested in colluding with workers to reduce contributions. Alternatively, if the worker’s benefits are reduced when the employer’s contributions do not materialize, the worker will not be interested in colluding with the employer to reduce contributions.\textsuperscript{24}

In our Chilean sample this collection problem affected the INP plans and those members of the AFP plans who believed that they would receive a minimum pension subsidy (see below). It did not affect the other members of the AFP plan, despite the fact that Chilean legislation allows employers to report accrued contributions without actually paying them because the AFP plan calculates benefits according to actual rather than accrued contributions. In Chile, in the case of an employer’s bankruptcy, workers’ claims have priority over other creditors’ claims, an aspect that may raise the cost of capital for an employer who routinely delays paying pension contributions. This also pits the worker against the evading employer.

For the period that I study, I captured the impact of this collection problem using two variables: (1) an indicator of the share of AFP contributors in the total number of contributors to both the INP and the AFP (an increase in this indicator should increase coverage) and (2) an indicator of the share of members of the AFP plans who can reasonably expect to receive a minimum pension subsidy and are thus more vulnerable if their employers evade paying contributions on their behalf. This can be represented by the ratio of the legislated floor for the minimum pension to average covered wages. As this ratio rises, coverage is likely to fall because the risk of evasion by the employer would rise.

The Size and Nature of Subsidies offered by First-pillar Pension Programs

\textsuperscript{23} McGillivray (2001) also argued that “there is little incentive for private fund managers to devote resources to compliance, since evaders are predominantly individuals whose contributions would be small and generate relatively high transactions costs. A centralized collection agency may pursue a more diligent enforcement policy.” I do not see why a centralized collection agency would not recognize the high transaction costs of collecting from small individuals, so I have chosen to disregard this point.

\textsuperscript{24} This problem was incorrectly attributed by McGillivray (2001, p. 7) to the method used to distribute the plan’s aggregate financial (mismatching) risk. He suggested that it affected defined benefit (DB) plans but not defined contribution (DC) plans. This is incorrect as shown by two counterexamples: in employer-sponsored DB plans, the problem is avoided because the same employer is the plan sponsor as well, and thus is the residual claimant if contributions are delayed. In the case of DC plans where legislation allows employers to report accrued contributions without actually paying them, the same problem arises if the plan is required to calculate benefits according to accrued contributions, not actual contributions. Thus, the problem is not DB versus DC but the efficiency of allocation of the collection risk.
First-pillar programs pay pensioners a targeted subsidy (as in Chile) or a flat universal subsidy (as in the Argentinean Pensión Básica Universal or in the Mexican universal flat subsidy to contributions). In the Chilean case, two targeted programs coexist, both financed through general taxation and whose benefits are legally incompatible:

- The Pensión Asistencial (or Assistance Pension subsidy) pays a flat amount and is distributed by social workers on a case-by-case basis to those who do not have other pension income (see Appendix 1).
- The Pensión Mínima Garantizada subsidy (or Minimum Pension subsidy) is targeted to members whose self-financed pension is below a threshold called “legislated pension floor.” The amount of this subsidy is the difference between the pension floor and the self-financed pension.

The Minimum Pension subsidy is definitely more attractive to beneficiaries than the Assistance Pension subsidy for three reasons. The first reason is size: the flat amount paid by the Assistance Pension is close to half of the floor legislated for the Minimum Pension. Second, beneficiaries are guaranteed to receive the Minimum Pension while acesso to the Assistance Pension is uncertain. The annual budget law allocates a fixed number of such pensions to each of the country's regions. There is a queue of applicants to fill the vacancies that are generated by the death of current recipients. The position of an individual in the queue is given by his or her need index. All this explains the uncertainty in obtaining the Assistance Pension.

Third, the Assistance Pension has eligibility requirements regarding the average per capita income of the recipient’s family, whereas the Minimum Pension does not. This makes a big difference for middle-class women who have worked part-time for money and in interrupted careers and thus have a low self-financed pensions, because they are eligible to receive the Minimum Pension subsidy even if their living standard is relatively high due to income earned by other family members. However, one eligibility condition of the Minimum Pension subsidy is the need to complete at least 20 years (240 months) of contributions. In contrast, the Assistance Pension subsidy does not require the recipient to have made any past contributions.

Some quirks in the integration between these two first-pillar programs should be mentioned. If the member made between 10 and 20 years of contributions to the INP plans, then she will receive the self-financed pension that results from the INP plans' benefit formula even if that pension is below the legislated floor. If that pension is above 50 percent of the pension floor, she will not be eligible for the Assistance Pension nor will she be eligible for the Minimum Pension subsidy because she has not completed 20 years of contributions. Therefore, she is excluded from both first-pillar programs. This does not happen to comparable members of the AFP plans. The funds in the member’s individual account are paid to her as a pension in an amount equal to the pension floor until the funds are exhausted, but once this happens, her pension will drop to zero, and this will make her eligible for an Assistance Pension. It can be seen that the difference in the time-path of payments offered by the INP and AFP plans affects eligibility for the Assistance Pension and creates inequity.
The eligibility conditions for both programs did not change during the sample period, but the real size of both the legislated floor and the Assistance Pension amount increased dramatically, almost in parallel. Thus, I had to take into account the impact on coverage of the size of the pension floor on the Minimum Pension subsidy. For this purpose, I developed the following simple model.

The objective of the worker is:

\[
(1) \quad \text{Max } U = P(C) \cdot V(F,C) - C
\]

where: 
- \( U \) = the satisfaction of the worker
- \( P(C) \) = the probability of becoming entitled to the Minimum Pension subsidy
- \( C \) = the number of contributions, which may be increased by the worker in order to meet the 20-year contribution requirement, \( \text{d}P/\text{d}C > 0 \)
- \( V(F,C) \) = the expected present value of the subsidy given entitlement
- \( F \) = the size of the pension floor ("legislated floor"). The government pays the difference between the self-financed pension and this floor (Minimum Pension subsidy). Thus, \( \partial V/\partial F > 0 \).

The benefit formula of the Chilean Minimum Pension subsidy implies that, within a range, additional contributions that raise the self-financed pension are fully devoted to reducing the fiscal cost of the subsidy, while the pension received by the member remains the same. Thus, \( \partial V/\partial C < 0 \).

In addition, raising the pension floor raises the range within which additional contributions are captured by the government and the pension received by the member does not rise. So \( \partial/\partial F[\partial V/\partial C] < 0 \).

This model implies that the individual incentive to contribute is:

\[
(2) \quad \frac{\partial U}{\partial C} = V(F,C) \cdot \frac{dP}{dC} + P(C) \cdot \frac{\partial V}{\partial C}(F,C) - 1
\]

As the size of the legislated floor, rises, this incentive changes according to:

\[
(3) \quad \frac{\partial}{\partial F} \frac{\partial U}{\partial C} = \frac{\partial V}{\partial F} \cdot \frac{dP}{dC} + P \cdot \frac{\partial}{\partial F} \frac{\partial V}{\partial C}
\]

Equation (3) proves that increasing the floor \( F \) has two effects:

(i) As the size of the pension floor rises and as the expected present value of the subsidy given entitlement increases, it becomes relatively more attractive for workers to increase their probability of being entitled to the subsidy by making additional

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25 Except for minor changes. Since 1995, recipients of the Assistance Pension do not have to enter the waiting list again after three years of receiving the pension. Since 1997, the amount of the Assistance Pension was raised with a flat “Winter Supplement,” which is more significant to recipients of the Assistance Pension than to recipients of the Minimum Pension subsidy.
contributions. This effect gives rise to the first term in equation (3). As this term is positive, raising $F$ has the effect of increasing coverage.

(ii) An increase in the pension floor expands the range within which additional contributions are captured by the government and where the pension received by the member does not rise. This reduces the expected contribution-benefit linkage, and this encourages a reduction in coverage. This effect gives rise to the second term in equation (3), which is negative.

As these two effects have opposite signs, this model proves that it is uncertain whether an increase in the pension floor will reduce or increase coverage. If one of these effects dominates, it should be revealed by the data. As the time period analyzed in this paper exhibits substantial variation in the level of the pension floor, our data set should be particularly revealing.

Degree of Funding of the Plan and its Changes

A mandate to save in a financial vehicle that offers a rate of interest that is no greater than the growth rate of GDP (such as pure pay-as-you-go finance) is equivalent to a tax on the labor income earned by covered workers. This is because the real interest rate is higher than the growth rate of GDP in the long run. This so-called “hidden tax” associated with pay-as-you-go financing encourages workers to avoid spending their entire careers in the covered sector of the labor market. Because this “hidden tax” is zero in a fully funded plan, such a plan should yield higher coverage rates in the long run than a pay-as–you-go plan. However, making a steady state comparison between these two kinds of financing is meaningless because during the transition from one to the other the general level of taxes and public debt may need to adjust substantially. During our timeframe,

In our sample, the methods of financing both the AFP (funded) and INP (unfunded) plans remained constant. However, the growth of the funded portion at the expense of the unfunded part implies that a major transition from pay as you go to full funding was taking place. The AFP plan substantially increased the size of its fund as a proportion of GDP, while the INP plans substantially reduced the aggregate size of the pension rights owed to their members as a proportion of GDP. Thus, the degree of funding, defined as the ratio of pension fund assets protected by property rights to the present value of pension rights owed to members, increased.

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26 Inactive individuals can also make up the missing contributions if they claim self-employed status and make voluntary contributions to the AFP plan (not to the INP plans).

27 This inequality is a requirement for equilibrium in the asset markets. If it is not met, then any organization of indefinite duration whose assets can grow with GDP will be able to issue debt at essentially no cost, because the service of interest would be smaller than the dilution effect allowed by growth in its assets in proportion to GDP. This implies that as the cost of funds (the interest rate) approaches the growth rate of GDP from above, the demand for funds will become infinitely elastic. Thus the market equilibrium in the funds market occurs at a real interest rate above the growth rate of GDP. Even if the country has no capital market and this arbitrage cannot be implemented, the over-accumulation of physical capital can be avoided through the appropriate family transfers and/or through public debt equivalents.
To identify the impact of this change on coverage, it must be recognized that the Chilean transition is being financed by a primary fiscal surplus (Diamond and Valdés-Prieto, 1994). Thus, general tax rates - mainly the value-added tax - have been higher than those needed to finance non-INP-related expenditures, thus increasing the distortions introduced by general tax rates and subsidy rates during the transition phase starting in 1981, which is expected to last until 2020.\footnote{28}

In the Chilean case, taxes on labor income were not raised to finance the transition (except in the period from 1981 to 1984, which is outside our sample period), so this increase in general tax distortions did not affect coverage during our sample period. On the contrary, in Chile, there was a substantial immediate reduction in the hidden tax rate affecting those in the covered sector who agreed to switch to the AFP plan after the reform in 1981, so I expected this increase in funding to increase coverage.\footnote{29}

Those who remained in the INP plans paid a contribution rate of 22 percent, while those who switched to the AFP paid a contribution rate in the 13-14 percent range. As general tax rates increased for all and public expenditure was reduced for all, this difference discriminated against those that remained in the INP plans. For those who did better in INP plans for other reasons, this discrimination made self-employment and home production more attractive.

Because of this discrimination, the increase in coverage generated by the Chilean transition is expected to be proportional to the share of contributors in the AFP plan in the total number of contributors to all plans (including the INP). Even though the share of the INP was already quite small in our sample period, I expected that further reductions in this share would increase coverage.

Summary of Pension Policy Variables that may affect Coverage

From the above discussion in Part II, here is a summary of the 10 variables that may have affected coverage in Chile during our sample period, each with its expected sign:

1. The average (real) level of flat commissions: negative.
2. The average wage commissions (times the Minimum Salary): negative.
3. The ratio between the number of transfers between fund management companies and the number of contributors: negative
4. The average age of contributors: positive.

\footnote{28} This point is essential when analyzing the situation of other reforming countries. Some countries have financed the transition from pay as you go to full funding by raising labor taxes disguised as contribution rates. This was the case of Argentina, where the government taxed wages at 16 percent to finance the transition deficit. The impact of this pension reform path on coverage is different from other reform paths where the value-added tax (VAT) rate is raised to finance the transition, or where state enterprises are sold to finance the transition.

\footnote{29} With other financing methods, a reform that increases the degree of funding of a given plan (or substitutes an unfunded plan for a new funded plan) may have no impact on coverage. For example, if the transition from pay as you go to full funding is financed by introducing an explicit and permanent wage tax, which would replace the hidden wage tax implicit in pay-as-you-go finance, the total tax on covered earnings would remain as before even though the plan would then be funded, and coverage should not be affected by this reform.
(5) An indicator of the phase of the business cycle: positive.
(6) The time index of uncertainty about property right protection for accrued and future pension rights: negative.
(7) The share of AFP contributors in the total number of contributors to the INP and the AFP, excluding seasonal effects (this variable represents three of the mechanisms described in Part II): positive.
(8) An indicator of the difference between the financial returns from pension funds and the financial returns offered by voluntary saving vehicles (which may interact with the indicator of the phase of the business cycle): positive.
(9) An index of collection risk, given by the ratio of the legislated floor of the minimum pension to average covered wages: negative.
(10) The (real) level of the legislated floor for the Minimum Pension: uncertain.

IV: Non-pension Factors that Influence Coverage

In this section, I review the non-pension factors that may affect coverage, specifically demography, economic growth, labor policies, health policies, and income tax policies. From among these factors, I identify seven non-pension variables that may have an impact on coverage. In the empirical part of this section, I find that four of these variables had a significant influence on coverage in the long run during our sample period. The rest had an influence in the short run or had no significant influence.

Demography

As my dependent variable is defined as the proportion of the population above the age of 15 who contribute to a mandated pension plan in any given month, my estimates controlled for changes in the size of the population.

Economic Growth and Macroeconomic Conditions

The relationship between coverage and economic growth runs both ways. On the one hand, an increase in coverage may make the labor market more efficient and thus increase the rate of economic growth, at least for a while. This happens when the social productivity of labor in the covered sector is greater than the social productivity in uncovered jobs. When growth is endogenous, an increase in coverage may have a permanent positive impact on the rate of economic growth. This does not seem to have been critical in our sample period, because the level of coverage did not rise by much and the rate of economic growth fell over time.

A different question is whether coverage is a function of the current level of average national income for a given rate of economic growth. In the past, it has been observed that the self-employed as a proportion of all employment fell as income increased, at least in the case of South Korea and probably of other countries that followed a similar path to industrialization (van Ginneken, 1999). The share of the self-employed in total employment is important because it affects the ability of the state to enforce the mandate to save for old age at viable costs. It may be infinitely costly to achieve high coverage in countries like Egypt or Mexico where a substantial share of employment demand comes from informal and family-based production units with

30 See the model by Corsetti and Schmidt-Hebbel (1997)
fewer than five workers about whom the state can only obtain earnings information at very high administrative costs. Such control costs would be much lower in, for example, South Korea, Germany, or Canada where a much higher share of employment demand comes from firms in the formal sector with more than five employees.

It is not only a matter of control costs. At any point in time, the legitimacy of a contributory pension plan requires that the inefficiencies and social costs created by the mandate to contribute be kept below the level of benefits provided by that mandate in terms of alleviating improvidence of members. This is one explanation for the fact that all countries provide legal exemptions for family members who work at home without a salary. In addition, it helps to explain why many countries exempt subsistence farmers and fishermen from contributing or exempt the self-employed in general, as Chile does.

The key question is whether economic growth will shift the structure of employment demand towards the kind of jobs in which the state can monitor compliance at a modest cost. Apparently, the answer depends on the structure of the economy. Some observers argue that, in countries that specialize in manufacturing, economic growth has increased the size of the service sector, and of self-employment. These observers fear that, in globalized and service-oriented economies, the control methods that were effective in the past may have become obsolete (Williams, 1999). On the other hand, the enforcement abilities of the state may well increase as national income increases and the tax authorities increasingly can afford to access the new information technologies.

Chile provides an interesting case study for measuring the net impact of income levels on coverage in a country that is not strong in manufacturing (as South Korea is). During the 1990s, Chile experienced very fast economic growth that raised real per capita GDP for the population over the age of 15 by 46 percent. Thus, I included as explanatory variable a monthly indicator of economic activity. It should be emphasized that the level of economic activity is heavily influenced by sound macroeconomic management and in the medium term by structural reforms. Any policy that hastens growth will have an impact on coverage through this mechanism, in the medium term.

Macroeconomic conditions, by which I mean the phase of the business cycle, is another factor that may influence coverage over and above the influence of the country’s level of economic activity. For example, if the economy is contracting, this may increase unemployment and may raise the cost to workers of liquidity constraints and credit constraints associated with mandatory contributions. Therefore, coverage may fall during recessions by more than what would be predicted based only on the country’s level of economic activity. In addition, formal sector firms are likely to be better able to survive during recessions than small firms led by self-employed workers. The labor demand from formal sector firms, especially from those firms that employ few low-skilled workers, is likely to be quite steady, and thus the number of covered workers may be relatively independent of the phase of the business cycle. Therefore, I incorporated an indicator of the phase of the business cycle as an explanatory variable. The most appropriate variable seems to be the difference between the 12-month average growth rate in monthly activity and the trend growth in activity.

The absence of a salary does not imply the absence of payment. Most families run an exchange between members by which some work at home and others work in the market for money wages, and together they produce and finance family public goods, which are jointly beneficial to all members.
Labor Policies

In this subsection, I discuss labor policy variables such as the level of the minimum wage and the level of mandatory severance payments. In Chile, those workers who are legally or in practice exempt from labor legislation are nearly the same as those who are legally exempt from contributing to second-pillar old-age pension plans. Therefore, it is likely that changes in labor laws that impose costs and benefits on covered labor markets will affect the coverage of the pension plans. I now review the main labor policy tools.

A Minimum Salary above Labor Productivity. Any increase in the Minimum Salary raises the income of low-productivity workers who stay employed. However, an increase in the Minimum Salary (a monthly wage) also prompts employers to refrain from hiring, to fire those workers whose monthly productivity is left below the level of the Minimum Salary, and to reduce the number of hours required from low-productivity workers. Regardless of the net impact on income inequality, the number of workers who contribute will fall, thus reducing coverage.

It is usually argued in the labor economics literature that the Minimum Salary may also affect workers who earn higher salaries than the minimum. This is possible for workers whose wages are set by bargaining and internal rules. For example, inside large organizations, it may be important to keep relative pay constant within the hierarchy to ensure that workers compete for promotion through the management structure. In this case, when not all low-income workers are fired by firms that are responding to the increase in the Minimum Salary, these employers may choose to increase the salaries of those employees higher up in the hierarchy just to keep relative pay constant.

This impact on other workers also arises in models where the hours supplied by different workers are perfect substitutes, so workers differ only in terms of their effective productivity (measured as the ratio between the output of this worker and the output of a worker of standard productivity). In this case, the firing of low productivity workers due to an increase in the (monthly) Minimum Salary reduces the overall supply of hours to the covered sector, thus raising the equilibrium wage per standard hour supplied. This effect should increase the monthly salary of all those that earn more than the minimum salary (Poblete, 2002). However, for workers whose work cannot be perfectly substituted by the increased hours of other workers, the value of marginal productivity for the employer should be above the supply price for the infra-marginal workers, leaving room for bargaining.

In any case, both stories imply that these other employees are not fired, so their coverage is not affected by an increase in the Minimum Salary. Although higher salaries may be affected, coverage is affected only at the cutting edge of the Minimum Salary.

In most of the sample period, nearly 20 percent of contributors to AFP plans reported receiving a monthly salary exactly at or below the minimum level. This

32 In June 2000, this figure was 19.1 percent. Some workers earn less than the “standard” minimum salary because the law sets lower minimum salaries for old workers and for housemaids (part of whose remuneration is received as food and, in the case of live-in maids, lodging). In addition, the INP plans
“bunching” in the reported earnings distribution is a standard finding for Latin America and elsewhere (Maloney and Núñez, 1999). Bunching is not an obvious outcome. If productivity is distributed among substitutable workers according to a continuous distribution (no mass points), then the number of workers earning exactly the (monthly) Minimum Salary should be a negligible share of the total at any point in time, and no bunching would occur.

Two explanations for this are possible. The first explanation may be that the hours supplied by different workers are far from perfect substitutes. This interpretation may not be so plausible for those who earn close to the Minimum Salary, although it is definitely relevant to workers with substantial human capital. A second explanation may be that workers’ reported earnings are below their actual earnings and that the distribution of these actual earnings does not show any bunching. In this interpretation, expanded in the next subsection, the bunching in reported salaries is a response of workers that attempt to minimize the taxes they perceive in mandatory social security.

Another implication of the standard notions about the impact of a minimum salary is that workers prefer the covered sector because earnings from self-employment are often below the Minimum Salary. However, surveys and journalistic reports show that many “car keepers” and street vendors in Santiago and other large cities in Chile earn around double the Minimum Salary, with the added advantage of having flexible schedules, freedom from malicious foremen, and no social security contributions. There is evidence that this situation is quite common in Latin America. It can be explained by a combination of efficiency wages and the similar labor productivity of uneducated workers in the covered and the uncovered sectors (Maloney, 1997).

These two pieces of evidence may cause us to question the view that the most important impact of the Minimum Salary is to induce employers to fire low-productivity workers, although that view may be valid for some sets of workers and for some time periods.

The Minimum Salary is a Floor on Contribution Amounts that sets the Effective Contribution Rate. Formal sector employers in Chile insist on issuing workers with employment contracts because the labor justice system is heavily tilted in favor of workers who accuse their employers of not having given them contracts (and of not having paid the agreed amount). However, when both the worker and the employer agree to reduce the amount of mandatory contributions to a pension plan, they can do so in the following way: the employer declares that the worker is earning the lowest permitted wage and the worker signs a receipt for his salary that is consistent with the wage specified in the contract and with the wage reported to the social security authorities. With consistent documents in place, it is very costly for the state to check whether the reported wage is less than the wage that the worker is actually receiving.

allow part-time workers to report a taxable earning equal to hours worked times the per hour Minimum Wage, even if it is below the monthly Minimum Salary.

33 Only 17 percent of the Chilean population live in rural areas.

34 The tax code exempts most small firms from keeping accounting records. Therefore, it is possible for their workers to earn a “black” salary (not reported to the authorities) in addition to the “official” salary reported in the employment contract. Other firms sell part of their output in the black market. If the employer is required by the tax authorities to keep full accounting records, the employer may pay the extra cash as an honorarium to a relation of the worker in exchange for fictitious services. Mandatory contributions only apply to the salary that is reported in the employment contract.
According to this view, both the covered and uncovered sectors are informal, although in different ways.

In June 2000, 19.1 percent of all contributors to AFP plans reported receiving a salary that was at or below the minimum level. This substantial proportion, which is representative of the decade, may be interpreted as showing that it is feasible to underreport taxable earnings and that the custom is widespread in Chile. It is a fact that 70 percent of self-employed contributors report receiving the Minimum Salary, 50 percentage points higher than dependent contributors. This can be explained by the fact that, when workers make additional contributions in order to meet the 20-year requirement for the Minimum Pension subsidy, it is least costly for them to do so by declaring the lowest taxable income.35

An additional advantage of this view is that it is compatible with evidence that the self-employed earn higher total wages than the Minimum Salary. Another piece of evidence in its favor is the low level of the average taxable salary declared by employers of house servants, which is way below the national Minimum Salary but above the special Minimum Salary for house servants.36 This view is also compatible with dependent workers being “rationed” in the sense that their contribution to a pension system is not determined by their preferences but by law (because the mandate is a binding restriction), as found by Barr and Packard (2002) for Chile.

If the size of the Minimum Salary controls the effective contribution rate, then my assertion in Part III above regarding the constancy of contribution rates during our sample period should be reassessed. As the Minimum Salary did change during the period in question, the effective contribution rate also changed.

In Part III, I argued that those workers who are either improvident or who see the illiquidity of mandated savings and the high commissions as prohibitive often choose to become self-employed, and, as a result, coverage falls. This implies that an increase in the Minimum Salary that raises the effective contribution rate would induce some employers of middle-income workers to attempt to reduce take-home salaries to compensate themselves for their increased costs. Provided that labor supply is elastic and that the workers in question do not think that the increases in their future pension benefits are worth the immediate reduction in their take-home salaries, then some of those workers will choose to quit, which again will reduce coverage.

In Part III, I showed that coverage among the subset of covered workers who expect to become entitled to the Minimum Pension is likely to drop the most.

35 See Superintendencia de AFP, Boletín Estadístico 156 for June 2000, p. 109. All of the workers in question reported receiving a Minimum Salary for a full month as taxable income, because the self-employed are not allowed to declare less than that amount to the AFP plans. However, the INP plans allow members to declare earnings at the minimum wage rate per hour, with monthly earnings way below the Minimum Salary. This means that a INP plan member who was determined to minimize his or her contributions while completing the 20-year contribution requirement could make up a false employment contract as a dependent worker for just one day per month, declare the minimum wage rate per day, and contribute the proportional amount that results, which is very small.

36 See Part IV below for a description. The average monthly contribution to severance savings accounts for house servants was Ch.$ 3.752 (US $6.8), which divided by the statutory contribution rate (4.11 percent) yields an average taxable salary for this group much below the national Minimum Salary. Figures for June 2000, taken from Superintendencia de AFP de Chile, Bulletin No. 156, page 114.
According to the current design of the Minimum Pension, higher contributions (due to a higher Minimum Salary) will reduce the amount of the Minimum Pension subsidy one for one, so the workers do not see any benefit from their additional contributions. For this subset of workers, the labor supply is fixed because their extra contribution would be worthless even if mandatory savings were liquid, commissions were zero, and they were provident. Given an elastic aggregate labor supply, the full incidence of the higher effective contribution rate will fall on employers, who tend to react by cutting back on jobs and coverage. Thus, workers who were expecting to have an uninterrupted work career in the covered sector that would entitle them to a Minimum Pension subsidy on retirement will lose that opportunity, either because their contribution record will be incomplete or because they will have to resort to working in part-time jobs. The will be the case even if their hourly wages are quite above the Minimum Salary.

Consider a regression where the coverage rate is explained by the (real) level of the Minimum Salary. The coefficient of the Minimum Salary can be interpreted as a measure of the extent to which the Minimum Salary controls the effective contribution amount times the impact of the effective contribution amount on coverage. Alternatively, the coefficient can be interpreted as a measure of the number of fired workers with productivity below the level of the Minimum Salary. Although both interpretations can coexist, the other facts mentioned in the first three paragraphs of this subsection favor the first interpretation, for this time period in Chile.

*Anticipation of Increases in the Minimum Salary.* The Minimum Salary in Chile is reset in June of each year. During the 1990s, the method to determine its level followed an elaborate public ritual. In April of each year, anticipating Labor Day (May 1), the Ministers of Labor and Finance would meet with the federation of Chilean labor unions in order to “negotiate” the forthcoming increase. In his Labor Day speech, the President would announce a final number, which was then included in a law proposal sent to Congress. However, under the tough Chilean constitution, Congress does not have the legal authority to propose a larger increase under so all Congress could do was rubber-stamp the proposal and enact the law just in time for the adjustment to be applied to wages paid in June. (See Appendix 1 for a fuller description of this process.)

This “negotiation” process gave employers ample time to fire workers before the new Minimum Salary became effective. This may have been optimal for some employers, since the mandatory severance payment is defined by law as being a multiple of the worker’s last salary, as discussed below. Thus, if an employer wanted to fire a worker who earned the Minimum Salary, it was cheaper to do so in May, just after the new Minimum Salary is announced and just before the Minimum Salary increases in June. Therefore, I expect coverage to fall one month ahead of any increase in the Minimum Salary.

*Mandatory Severance Payments.* Chile has had a mandatory severance payment law for private sector dependent employees at least since the 1960s. It requires employers who fire a permanent worker to make a minimum severance payment expressed as a function of the number of years that the worker had been employed at that firm. In 1981 the Pinochet regime reduced the minimum severance payment to one month’s salary per year of employment with a ceiling of five times the worker’s last salary for those hired after 1980. This law was again reformed in late 1990, raising this
ceiling (for minimum payments) to 11 times the worker’s last salary for those hired after 1980. This reform went into effect in January 1991 and remained in force for most of the sample period. A new reform to mandatory severance payments was enacted in late 2001, but it was not applied until after the end of our study period.

It is likely that the 1990 severance payment reform had a negative effect on coverage. One reason is that some employers in the covered sector reacted to higher firing costs by substituting machinery for labor. In addition, other employers reacted by firing unskilled workers who tended to have a high turnaround and thus high firing costs for more skilled workers who were likely to stay in the job for longer and thus have lower average firing costs per unit of time. As skilled workers were covered anyway because they always work in the formal covered sector while unskilled workers have self-employment as a competitive option, this change in composition also probably reduced coverage.

An index that captures the impact of this reform is the one devised by Pagés and Montenegro (1999), which calculates expected firing costs under some assumptions. I used the version constructed by Heckman and Pagés (2000).

Mandatory Severance Savings Accounts for House Servants. The same law that reformed severance payments forced employers of house servants, for the first time, to contribute an amount equivalent to 4.11 percent of the servant’s salary to a new individual account owned by her. This money is not just used to fund severance payments, as one might imagine, because the worker can access this money at any time by agreeing with his or her employer to be simultaneously fired and rehired under a new employment contract. The dismissal document is the only requirement that the worker needs to access the funds in his or her severance savings account. The liquidity of these accounts is a marked contrast with old age saving accounts.

One concern is that the costs of administering these accounts may exceed the value of the funds. For example, the average withdrawal upon “severance” is Ch.$ 66,000 (US$120), which is well below the minimum salary level. There were 450,000 accounts with a positive balance in June 2000, but the number of new monthly deposits was much smaller, about 100,000 per month (about 1.7 percent of total employment). However, administrative costs cannot affect coverage in this sample because the owners of the AFP have agreed to manage these accounts at no charge. Of course, the underlying causes of this arrangement and its social cost remain a concern.

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38 Due to the informal aspects of labor contracts in the formal sector, explained before, the mandatory severance payment laws are not as effective as one may first imagine. The employer is legally exempt from the mandatory severance payment when the firing is due to the worker’s theft or to his or her lack of punctuality. The long queues at labor tribunals ensure a long wait for those workers who claim higher severance payments than those the employer is willing to pay, and out-of-court settlements seem to push actual severance payments far below legal levels. However, these aspects do not deny that the negative impact of the 1990 reform on coverage.
39 The average account balance is just Ch.$ 67,500 (US $122). The source of the data in this paragraph is Superintendencia de AFP de Chile, Bulletin No. 156 for June 2000, page 114.
40 Although this is an informal agreement between the authorities and the AFP, the data show that it has been rigorously respected. In exchange for this political favor to the authorities, AFP owners may have expedited a decision not to reform the AFP plans.
Some observers think that the introduction of mandatory severance savings accounts for home servants had a positive impact on coverage, because this payment is financed by employers and is valued by home servants because of its liquidity, making formal employment more attractive. A more standard analysis would also take into account the employers’ side of the market. If the severance contribution is perfectly liquid, then a natural outcome that suits both workers and employers would be to reduce the wage declared in the employment contract by the equivalent of the 4.11 percent, keeping the employer’s cost at its original level, with no impact on coverage.

However, the Minimum Salary may be binding on this kind of employment and prevent this adjustment. In this case, the mandatory severance contribution is likely to be perceived by both the employer and the employee as the imposition of a 4.11 percent increase in the contribution amount. This reduces employment and coverage, although it helps those home servants lucky enough to remain employed. Our data set cannot be used to resolve this issue because the severance savings account for home servants became effective in January 1991, at the same time as the general severance payment legislation was modified. Therefore, the Heckman and Pagès index measures the joint impact of these two policy reforms.

Uncertainty Caused by the Labor Law Reforms of 1990-1991. As mentioned before, the opposition parties to Pinochet announced in their campaign platforms for the 1988 referendum and the 1989 Presidential election that they would reverse the pension reform of 1981. These leaders had also opposed the changes to labor law made by the Pinochet regime since 1978 and had promised during the 1988 and 1989 campaigns to reverse them. After coming to power, the new leaders chose to ignore the first campaign promise and to focus their efforts on meeting the second promise. The first reform concerned mandatory severance payments, and its impact was discussed above. The second reform was concerned with union law and was enacted in February 1991. A third reform focused on collective bargaining law and was enacted in July 1991.

These reforms caused substantial anxiety among employers, in part because critical provisions were bitterly discussed in Congress and the press and in part because their judicial interpretation was uncertain. Fearing large increases in labor costs, some employers reacted to these labor laws by substituting machinery for labor and skilled labor for unskilled labor. Both actions reduced coverage.

Later it became clear that the new government’s campaign promises about labor law reform had also been abandoned in practice, so these reforms were not as

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41 See interview in newspaper El Diario, December 26, 2001, with Mr. Mario Marcel, Budget Director.
42 Adjustments to hours worked may ameliorate this result. Provided that the state cannot observe the actual number of hours worked by non-resident house servants and bearing in mind that the INP allows members to contribute on the basis of a monthly salary below the minimum salary provided the wage rate is above the minimum wage rate, a worker could reduce the number of declared working hours as a feasible method for reducing declared earnings and contributions. This strategy is feasible under the INP (as confirmed at their website consultasinp@inp.cl) but it is not feasible under the AFP (as confirmed at their website consultas@safp.cl). However, this adjustment is not feasible for live-in maids, whose hours can be observed by the state.
43 The second and third laws were No. 19.049 (Official Register February 19, 1991) and No. 19.069 (Official Register July 30, 1991).
44 They argued that this was necessary to protect the return to democracy. This explains why further law reforms were an important part of the center-left platform in the subsequent presidential campaigns of 1993 and 1999.
effective in raising real wages as union leaders had wished or as employers had feared. Also, in the next few years, equilibrium real wages were pushed up by economic growth, which further quieted employers’ anxiety.

The likely impact of this process is that coverage probably started falling at the time when the election of the center-left parties became certain - after the 1988 referendum - and this effect probably peaked close to the time of the enactment of the labor law reforms. Later on, this effect would gradually have been reversed, as these reforms came to be seen innocuous. Thus, I expected that an index would start high in 1990 and then decline exponentially to zero, would capture the impact of labor policy uncertainty on coverage.

However, the indicator of this impact on coverage overlaps with the indicator described in Part III of the impact fears that the new government might modify the AFP benefit formula to the detriment of provident workers. This is not a coincidence, as both sets of fears were an integral part of a political transition during which the new rulers that had opposed both the pension policy reforms (which created the AFP plans) and the labor policy changes implemented by the Pinochet regime, chose to reverse both policy stances after reaching power. Therefore, the data cannot be expected to distinguish between these two effects on coverage.

Health Policies

Access to health services and health insurance in Chile depends on the employment status of the contributor and on his or her level of declared taxable earnings. The main health service provider is the network of 178 state-owned hospitals and 1,700 health posts. Workers can access the services of the state hospitals in two ways. One way is to become partially insured by FONASA, a state-owned health insurance outfit. The other way is to become eligible to receive direct service from the state hospitals, called “Institutional” service. The eligibility conditions for receiving "Institutional" service are the following: (1) having lacked any permanent source of income in the previous 12 months; (2) not having contributed for more than 12 of the previous 24 months to an AFP or INP plan; (3) the individual must be classified as “lacking resources” by a social worker in a health post or hospital or by a social worker from the municipality. Only occasionally does the social worker visit the home of claimants to check the quality of housing and ownership of consumer durables.

Dependent workers fail to meet at least one of those requirements, but they are eligible for FONASA benefits once they are able to show that they have made contributions in at least six out of the previous 12 months. The health card obtained in this way remains valid for 24 months. The contribution rate for health insurance at FONASA is 7 percent of taxable earnings.

45 I omit any discussion of private health insurance plans offered by ISAPREs, which are regulated insurance firms for profit. Any worker can opt out of FONASA and direct his 7 percent health contribution to one of these plans. The result of competition between private insurers is that workers with higher earnings obtain health insurance with a higher degree of insurance or higher quality as in individual accounts. Due to the huge fiscal subsidies to the FONASA plan and to the network of state-owned hospitals, these private plans cannot compete for workers for whom the higher quality of service is too expensive, in other words, those with earnings lower than the average wage.
Therefore, the issue for dependent workers is price, not access. The law specifies that FONASA prices depend on declared earnings: if the dependent worker has an employment contract stating that he or she earns the minimum salary (or less if they are working in a part-time job), then he or she has free access through FONASA to the state-owned hospital network. For workers with higher declared earnings, the rate of insurance is smaller. The rate schedule was reformed in December 1999. If the worker’s employment contract specifies his salary as $1 above the Minimum Salary, then his insurance through FONASA pays 80 percent until December 1999 and 90 percent thereafter, of the price of medical services, and the worker pays the remainder. If his employment contract specifies a salary above (approximately) 146 percent of the Minimum Salary, his insurance rate through FONASA was 50 percent until December 1999 and 80 percent thereafter of the price of medical services. As the contribution rate for health is 7 percent of the declared salary regardless of the amount covered by FONASA insurance, there are economic incentives for dependent workers to agree with their employers to report the lowest possible taxable wage, which cannot be below the Minimum Salary. The size of these incentives was reduced significantly in December 1999, when the out-of-pocket payment fell from their previous levels of 20 percent and 50 percent of the price of medical services, to 10% and 20%, depending of the salary bracket.

For a self-employed worker, both the “Institutional” service and the FONASA 100 percent insurance channels are free of charge and attainable. However, the FONASA insurance is more expensive because it requires the worker to contributing towards health insurance 7% of the declared salary, and also to contribute to an AFP or INP plan for old age security (13 percent or 22% of the declared salary, depending of the plan) at the same time. Therefore, almost no self-employed workers use the FONASA 100 percent insurance channel.

In August 2001, there was a national scandal when it was discovered that 500,000 people who had been given “lacking resources” status at FONASA had also declared income taxes in 1999. The only workers who are required to declare income taxes in Chile are those who earn more than the average salary and, in addition, have at least one source of income other than a dependent worker’s salary. This and other data suggests that a much larger number of people have obtained the “lacking resources” status at FONASA without being poor. For example, in 2001 FONASA reported serving 6.7 million workers and pensioners (not counting their children and other dependents) and that 46 percent of them had the “lacking resources” status. This percentage is far above the proportion (close to 20 percent) of Chilean people who are below the official poverty line.

Health policy can have several implications for coverage of old age pension plans. Combined contribution and health subsidy schedules can create additional economic incentives for dependent workers to collude with their employers to report that they receive the lowest possible taxable wage, thus leading to “bunching” in the reported earnings distribution at the level of the Minimum Salary. These combined schedules also create a definite incentive for self-employed workers not to contribute to

the AFP or INP plans. This may help to explain the low level of voluntary old age coverage of the self-employed.

Although several of these incentives remained nearly the same throughout the full study period, those incentives associated with the changes in the (real) level of the Minimum Salary did not. An increase in the (real) level of the Minimum Salary makes dependent jobs more expensive because net contributions to FONASA rise by at least 7 percent of the increase, making it more attractive for workers to become self-employed given that the “Institutional” service channel provides health care of a similar level and quality. In addition, the change in the health subsidy schedule that was made at the end of 1999 reduced the cost of health care from 20 percent to 10 percent of the state hospital fees for medical services for those dependent workers who report receiving earnings that were at least $1 above the Minimum Salary, making it less attractive for them to become self-employed. Thus, I introduce an indicator variable that has a value of 20 until December 1999 and 10 thereafter. I expect it to have a negative coefficient in terms of its effect on coverage.

**Income Tax Policies**

If there is a different effective income tax rate for the covered and uncovered sectors, this difference may influence coverage. It is easier for the state to observe the earnings paid to formal sector employers than the earnings of the self-employed. Going to the extreme, I have assumed that the marginal tax rate levied on dependent workers’ earnings is the one set by the law, while the effective marginal tax rate levied on other labor earnings is zero. However, I found that during the study period workers earning the average covered wage always fell into the income tax bracket where the marginal tax rate is zero. In other words, Chilean law exempts most formal sector workers who may be tempted to become self-employed from the income tax. Thus, income taxes cannot affect coverage in our sample period.

**Summary of Non-pension Variables that may affect Coverage**

From the foregoing discussion in Part IV, it is likely that the following seven variables affected coverage during our sample period in either a positive or a negative way.

1. An indicator of economic activity: positive.
2. An indicator of the phase of the business cycle: positive.
3. The level of the contemporaneous (real) Minimum Salary (governs effective size of mandatory contribution to both old age plans and to health insurance): negative.
4. A one-month lead in the change of the (real) Minimum Salary: positive.
5. An index of firing costs constructed by Heckman and Pagès: negative.
6. A time index of labor policy uncertainty that starts high in 1990 and then declines exponentially to zero: negative.
7. An indicator of the size of subsidies to health care in state hospitals: negative.

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48 This definition assumes that an index of the health services prices charged at state hospitals, and service utilization at the state hospitals, remained constant in real terms throughout the sample. I assume this because of a lack of data.
As variables (3) and (8) duplicate two of the pension policy variables, the final number of explanatory variables was 17. This number was increased by the fact that the real rate of return variable has two versions, and by the necessity to include seasonal dummies.

V: Estimated Equations and Empirical Results

My general approach is governed by what data were available and by economic and statistical considerations. I start by discussing the dependent variable.

Monthly data on contributors to AFP plans is available for the years since 1990 (they are also available for earlier years but some explanatory variables were not available for that earlier period). However, there is no monthly series of data on contributors to the INP plans. The authorities were kind enough to give me access to the data folders from which the INP builds its data, so I built a monthly series myself. However, this starts only in April 1995.

Functional Form and Equation Design

Economic considerations governed my selection of a functional form. The impact of economic variables on the coverage rate must be independent of the size of the population. For example, the Minimum Salary should have the same impact on the coverage rate regardless of whether the population is 5 million or 50 million. For this reason, I chose a coverage rate as the dependent variable in my long-run model, and, in doing so, I eschewed functional forms where population and other factors explain the number of contributors. An implication of this decision is that the index of economic activity had to be scaled by the level of population over the age of 15 to act as a suitable explanatory variable of the coverage rate.

The next stage was to test whether this dependent variable was stationary (in other words, if it was free from permanent shocks). I found (see the first table in Appendix 2) that the coverage rate is I(1) over the full sample period. However, it could be described as I(0) and subject to structural breaks for shorter periods that started in 1995 or later.

In my regression, I tried to explain these apparent structural breaks with the economic and policy variables that I described in Parts III and IV. For example, an apparent break in 1998 may have been caused by a reduction in the growth rate of per capita economic activity in early 1998 or by the increase in the Minimum Salary or even by the increase in flat commissions. However, the last explanation is unlikely because the rise in flat commissions occurred in two distinct stages, not one.

I had two choices. One was to interpret COVAFP as I(1). The other was to interpret COVAFP as I(0) and to introduce statistical tests to identify the location of structural breaks. However, such breaks would not have a clear economic justification given that the regression was controlling for changes in economic and policy variables.

I also had to take statistical considerations into account. By taking the I(1) description, I was able to use an error-correction model that allowed me to separate a
parsimonious long-run relationship between the coverage rate and the explanatory variables from the equation that governs the short-run evolution of the coverage rate. This separation is useful for policy analysis in the case of a sample period like ours in which almost 20 explanatory variables (including seasonal dummies and the December 1990 dummy) must be considered, because it cuts down their number to those that are really critical for the long-run level of coverage.

The stationary description is possible as well but does not have this desirable characteristic. Most critically, choosing the stationary description would have required me to eliminate almost half of the data, in other words, the data from the 1990-1994 period, which obviously would have reduced the precision of my estimates. In addition, it would have required the statistical identification of structural breaks that do not have a clear economic justification. Finally, it will be seen below that the error-correction term in the short-run equation was highly significant, suggesting that modeling coverage as I(1) was appropriate. For all these reasons, I chose to interpret COVAFP as a I(1) variable.

This implies that for the long-run equation, I had to restrict my attention to explanatory variables that were of the same order of integration as the dependent variable. This excluded variables that were deterministic functions of time (time trends, exponential time indices, seasonal dummies, and the December 1990 dummy) and variables that had a mean that was independent of time. This criterion limited the explanatory variables for the long-run regression to the following two classes:

(a) Variables that are part of an economic equilibrium and can be described as having suffered permanent shocks without structural change during the sample time period (non-stationary); and
(b) Direct policy variables such as the Minimum Salary and the floor of the Minimum Pension and “almost direct” policy variables such as AFP commission levels and churning rates. As the policy variables can always be defined as being subject to structural change coming from the political equilibrium, the purely statistical tests to classify them as stationary or non-stationary are not relevant.

The following three variables were compatible with criterion (a):
(1) Contributors per capita in the population over the age of 15 (dependent variable): COVAFP (for AFP contributors only) for the full sample period.
(2) An indicator of economic activity per unit of population over the age of 15: ECACTIV
(3) The average age of contributors, not stationary in our sample: AGE.

The following eight variables were compatible with criterion (b):
(4) The level of the contemporaneous (real) Minimum Salary: MINSAL
(5) The level of the legislated (real) floor for the Minimum Pension: MINPEN
(6) An index of collection risk, given by the ratio of the legislated floor for the Minimum Pension and average covered wages (the floor is a policy variable): COLL
(7) An index of firing costs, controlled by severance payment legislation: FIRING
(8) An indicator of the size of subsidies to health care in state hospitals: HEALTH
(9) The ratio between the number of transfers between fund management companies and the number of contributors: CHURNING
(10) The (real) level of flat commissions (average): FLATCOM
(11) The wage commission rates times the Minimum Salary (average): WCOMMW

The other explanatory variables identified in Parts III and IV were not directly affected by policy and were stationary (see Appendix 2).

Another issue concerns high collinearity between some explanatory variables. The time trend was almost collinear with average age in this sample period. If I had put both variables in the regression and I had taken into account the fact that I may have measured average age with error, then the time trend may have taken away the impact of the rising average age on coverage, which is what I was interested in. Thus, I decided to leave in the regression only one of these two variables, average age (AGE), on the understanding that its coefficient captures two economic effects rather than one – delayed adaptation by workers to the burden placed on them by the mandate on the covered sector and an increasing awareness among workers of the reality of old age as their retirement comes closer.

The number of contributors to AFP plans appear to have an outlier in December 1990 when the number of contributors to the AFP plan rose, only for that month, by 3.5 percentage points of the population over the age of 15. This anomaly seems to be the outcome of the first review of the backlog of contributions that had accumulated since 1981. Due to administrative confusion, a number of younger workers had contributed but had not become members in the sense of having an individual account. The Superintendency of the AFP ordered the fund management companies to create individual accounts for these young people, to whom the backlog of contributions was credited in December 1990. As many of those individuals were not working in the covered sector anymore, they did not contribute in the following month, and the number of contributors fell again in January 1991. Afterwards, these reviews became routine, so there ceased to be any noticeable statistical effects in particular months. For this reason I add a dummy for December 1990 to the explanatory variables.

Findings

I found a cointegrating vector at the 5 percent confidence level (which is shown in Appendix 3) for the full sample period (140 data points starting in 1990:01). I verified this result by trying the same equation with an expanded dependent variable: the sum of contributors to INP and AFP plans divided by the population over the age of 15, which is available for a smaller sample only (78 data points starting in 1995:03). This new regression had to exclude the index of firing costs as an explanatory variable because there were no reforms to mandatory severance payments during this shorter sample period. As shown in Appendix 3, there exists a coefficient vector that cointegrates at the 5 percent level with the expanded dependent variable, and this vector

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49 The correlation coefficient between average age and a time trend is 0.9868.
50 This number is the coefficient for a dummy for December of 1990 in an autoregressive equation for the dependent variable, expanded with seasonal variables.
51 I thank Mr. José Suárez, from the Superintendency of AFP, for this explanation.
is similar to the one that I found for the full sample. This consistency increased my confidence in these empirical results.

Table 1 shows two “reduced” long-run equations that exclude the less significant explanatory variables and still cointegrates at the 5 percent level for both definitions of the coverage rate (including and excluding INP contributors, covering different sample periods). I made the exclusions by eliminating stepwise the explanatory variables with p-values above 0.07, provided that cointegration was preserved. As the preferred specification is the same for both definitions of the coverage rate, and the coefficients are not too far apart in magnitude, I have substantial confidence in the reliability of the results (see Table 1).

Table 1: Reduced Long-run Cointegrating Equation for Coverage

<table>
<thead>
<tr>
<th>Dependent Variable: COVAFP</th>
<th>Method: Least Squares</th>
<th>Sample: 1990:01 2001:08</th>
<th>Included observations: 140 after adjusting endpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Coefficient</td>
<td>Std. Error</td>
<td>t-Statistic</td>
</tr>
<tr>
<td>C</td>
<td>-0.417971</td>
<td>0.121577</td>
<td>-3.437909</td>
</tr>
<tr>
<td>ECACTIV</td>
<td>2185.432</td>
<td>720.1844</td>
<td>3.034546</td>
</tr>
<tr>
<td>AGE</td>
<td>0.021418</td>
<td>0.004223</td>
<td>5.071249</td>
</tr>
<tr>
<td>MINSAL</td>
<td>-7.38E-07</td>
<td>1.75E-07</td>
<td>-4.219521</td>
</tr>
<tr>
<td>HEALTH</td>
<td>-0.000527</td>
<td>0.000278</td>
<td>-1.897191</td>
</tr>
<tr>
<td>FLATCOM</td>
<td>-8.15E-05</td>
<td>9.43E-06</td>
<td>-8.640159</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.901069</td>
<td>Mean dependent var</td>
<td>0.286905</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.897377</td>
<td>S.D. dependent var</td>
<td>0.018814</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.006027</td>
<td>Akaike info criterion</td>
<td>-7.343242</td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>0.004867</td>
<td>Schwarz criterion</td>
<td>-7.217171</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>520.0269</td>
<td>F-statistic</td>
<td>244.0954</td>
</tr>
<tr>
<td>Durbin-Watson stat</td>
<td>1.366340</td>
<td>Prob(F-statistic)</td>
<td>0.000000</td>
</tr>
</tbody>
</table>

ADF Test Statistic | -5.391204 | 1% Critical Value* | -2.5806 |
|                   | 5% Critical Value | -1.9422 |
|                   | 10% Critical Value | -1.6169 |

Dependent Variable: COVTOT
Method: Least Squares
Sample: 1995:03 2001:08
Included observations: 78 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.149011</td>
<td>0.190122</td>
<td>-0.783765</td>
<td>0.4357</td>
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<tr>
<td>ECACTIV</td>
<td>2778.052</td>
<td>1047.263</td>
<td>2.652679</td>
<td>0.0098</td>
</tr>
<tr>
<td>AGE</td>
<td>0.014574</td>
<td>0.006504</td>
<td>2.240621</td>
<td>0.0281</td>
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<tr>
<td>MINSAL</td>
<td>-1.24E-06</td>
<td>3.07E-07</td>
<td>-0.436388</td>
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<tr>
<td>HEALTH</td>
<td>-0.000126</td>
<td>0.000323</td>
<td>-0.389588</td>
<td>0.6900</td>
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<tr>
<td>FLATCOM</td>
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<td>1.83E-05</td>
<td>-1.552297</td>
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<tr>
<td>R-squared</td>
<td>0.586339</td>
<td>Mean dependent var</td>
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<tr>
<td>Adjusted R-squared</td>
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<td>S.D. dependent var</td>
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<td>Akaike info criterion</td>
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<td>Sum squared resid</td>
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<td>Schwarz criterion</td>
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<tr>
<td>Log likelihood</td>
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<td>F-statistic</td>
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<td>Durbin-Watson stat</td>
<td>1.187157</td>
<td>Prob(F-statistic)</td>
<td>0.000000</td>
<td></td>
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</tbody>
</table>

ADF Test Statistic | -3.312157 | 1% Critical Value* | -2.5937 |
|                   | 5% Critical Value | -1.9446 |
|                   | 10% Critical Value | -1.6180 |
All the coefficients in the COVTOT equation are less significantly differently from zero than in the COVAFP equation, a fact which confirms my concern about the importance of avoiding the use of the shorter sample period (78 versus 140 observations). Also important is the fact that all of the coefficients in the COVTOT equation are larger than in the COVAFP equation. This outcome suggests a further reason to prefer the results of the COVAFP equation: the use of the (smaller) coefficients of the COVAFP equation ensures that I am not overstating the impact of policy on coverage.

As anticipated, the error correction approach allowed me to estimate a short-run equation to predict changes in the coverage rate (DAFP). In this equation, I took as possible explanatory variables the first differences of all the economic variables that might have been important in the long-run equations, including those that I eliminated in the reduction process, plus those economic variables shown in Appendix 2 to be stationary and those identified in Parts III and IV as not related to policy. The names of these variables are:

1. An indicator of the phase of the business cycle: PHASE.
2. A time index of uncertainty about pension and labor policy: UNCERTAIN
3. An indicator of the share of AFP contributors in total contributors to both INP and AFP plans, smoothed to exclude seasonal effects: SHAREAFP.
4. An indicator of the difference between the financial return of pension funds and the financial return offered by voluntary saving vehicles: RETURN.
5. An index of severance costs constructed by Heckman and Pagés: SEVERANCE

The explanatory power as measured by the R-squared was a very satisfactory 73 percent even in the absence of lagged dependent variables. Moreover, all the variables have coefficient signs that either agree with the predictions of economic analysis (Parts III and IV) or are insignificantly different from zero.

Table 2: Short-run Equation for Changes in Coverage

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.029546</td>
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<td>-0.240093</td>
<td>0.8107</td>
</tr>
<tr>
<td>D(AGE)</td>
<td>-0.299346</td>
<td>0.267915</td>
<td>-1.117315</td>
<td>0.2663</td>
</tr>
<tr>
<td>D(MINSAL)</td>
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<td>-5.768425</td>
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</tr>
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</tr>
<tr>
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<td>0.008208</td>
<td>-3.841527</td>
<td>0.0002</td>
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<td>-1.493040</td>
<td>0.1382</td>
</tr>
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<td>D(MINSAL(+1))</td>
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<td>1.46E-07</td>
<td>1.334181</td>
<td>0.1849</td>
</tr>
<tr>
<td>D(HEALTH)</td>
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<td>0.000429</td>
<td>-0.632453</td>
<td>0.5284</td>
</tr>
<tr>
<td>PHASE</td>
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</tr>
<tr>
<td>RETURN-PHASE</td>
<td>0.017185</td>
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<td>1.075452</td>
<td>0.2845</td>
</tr>
<tr>
<td>DUM (DEC 1990)</td>
<td>0.032904</td>
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<td>7.006978</td>
<td>0.0000</td>
</tr>
<tr>
<td>OCTOBER</td>
<td>-0.006688</td>
<td>0.001549</td>
<td>-4.316633</td>
<td>0.0000</td>
</tr>
</tbody>
</table>
VI: Policy Implications

The empirical results in the reduced long-run equation (Table 1) show that coverage depends on aging. As a population ages, this appears to increase people’s awareness of the reality of old age, thus reducing the extent to which they perceive mandatory contributions to pension plans as a pure tax. This interpretation is consistent with the microeconomic evidence reported by Packard (2002), who found that Chilean respondents who expect to live longer choose to contribute more through a higher density of contributions. The AGE variable can also be interpreted as a proxy for learning and adaptation to the burden placed by the mandate on workers in the covered sector. According to my results for the longer sample, if the average age of contributors were to increase by four years, say, due to reduced fertility and higher longevity, coverage would increase in the long run by 8.56 percentage points of the population over the age of 15. (In Chile, this would mean 953,800 more contributors, provided that the population is fixed at the August 2001 level).

The evolution of the awareness of aging cannot be affected by governments in democratic societies. However, my empirical results show that the authorities have at their disposal other policy levers that allow them to determine coverage levels to a substantial extent. The coefficients from the reduced long-run equation for the longer sample (Table 1) have several policy implications, which I now discuss in turn.

Economic Growth has a Positive Impact on Coverage

The first finding from Table 1 is that economic growth has a positive impact on coverage. It is well established that sound macroeconomic management and structural reforms can hasten the rate of economic growth. This is a major tool for increasing coverage, as shown by Figure 1.
Looking towards the future, if GDP growth is 3 percent per year more than population growth instead of 0 percent per year due to better macroeconomic management, after five years per capita income will have grown by 16 percent. Considering the sample average of ECACTIV (economic activity per person over age 15), this will increase coverage by 0.76 percentage points of the population over the age of 15.

The Minimum Salary Controls the Effective Contribution Rate

The second finding from Table 1 is that the Minimum Salary set by the authorities controls both the effective contribution rate to pension plans and access to state hospitals of poor workers who have the alternative of becoming self-employed. The rapid increase in the Minimum Salary observed in the final three years of the sample (1998 to 2001) may also have reduced the employment rate of workers with low productivity. One implication of this is that the authorities can be raise coverage simply by failing to increase the real amount of the Minimum Salary. Of course this would be politically difficult to do, so I discuss below other ways to achieve this aim. Figure 2 shows what would have happened to AFP plan coverage if the Chilean authorities had kept the Minimum Salary at the same real level it had in February 1990 from then until August 2001.
The result is that coverage at this latter date would have been higher by 3.69 percentage points of the population over the age of 15. (In Chile, this would have meant 409,300 more contributors as of August 2001 than was actually the case.) This may have been a viable strategy in Chile if it had been implemented at the beginning of the 1990s when the Minimum Salary was low, but that opportunity has now been lost.

Looking towards the future, it may be useful to consider cases where the Minimum Salary is initially too high. In this situation, the (real) Minimum Salary can be reduced gradually over time by expanding exemptions and creating lower minimum rates for the young and for other groups that suffer the largest losses of employment.

Before pushing for this policy, it is important to consider whether it improves welfare as opposed to increasing coverage, taking into account both equity and efficiency. When the Minimum salary affects actual earnings, and provided the elasticity of labor demand to wages is below 1, so the wage bill rises when the minimum salary is increased, the tradeoff is efficiency versus income redistribution in favor of labor. However, I have shown in this paper that the Minimum Salary may be affecting reported earnings not actual earnings. In this situation, it would not be possible to trade off a lower level of employment for a higher level of actual wages, because the latter are either unaffected or fall.

Now consider the impact of reducing the Minimum Salary on reported earnings and on welfare. First, middle-income workers who currently report receiving earnings greater than the Minimum Salary would not be affected by a reduction in the Minimum Salary because they report higher salaries anyway. Second, for the nearly 20 percent of covered workers who report receiving the minimum wage, the main impact would be to reduce the size of the mandatory contribution. This would have several effects:

i) It would help poor workers who already work in the covered sector and their young children by increasing their effective take-home wage (in other words, the “black” portion – the portion that is not reported to the authorities – of their earnings would increase).

ii) It would force the state to spend more on the Minimum Pension subsidy and on health care for poor workers. The losers from this policy would be taxpayers, especially future taxpayers who would have to finance higher state spending. iii) The
welfare of poor workers when they grew old would not suffer if the legislated pension floor remained the same, because the Minimum Pension subsidy would grow automatically to replace their smaller contributions on a 1 for 1 basis.

iv) This policy would increase coverage, drawing additional poor workers out of self-employment and into the formal sector, increasing the number of poor workers who qualify for the Minimum Pension subsidy, and thus increasing their welfare when old.

Any analysis of the impact on welfare should also take efficiency into account. The increase in tax rates on middle- and high-income taxpayers that would be required to pay for the additional fiscal expenditure would involve a loss of efficiency because their work incentives would be diminished and they may be more inclined to try to evade paying their taxes. On the other hand, reducing the effective mandatory contributions of the poor would increase the efficiency of their labor decisions. This is clearly true for workers who do not expect to receive the Minimum Pension subsidy, because the net tax on covered sector jobs falls as reported earnings are allowed to Efficiency losses are also likely to be small in the health sector. At FONASA the utilization of health services is governed by the amounts that the patient must pay, which is independent of the declared salary. The 7 percent contribution affects coverage only and not the rate of utilization, and coverage rises when reported earnings are allowed to fall.

Thus, counter-intuitively, left-wingers should favor reducing the Minimum Salary because it helps the poor both by increasing the transfers that they receive and by increasing the efficiency of their labor decisions. This paradox can be explained by observing that the Minimum Salary affects only reported earnings and not actual earnings.

**Health Subsidies have a Positive Impact on Coverage**

The third finding in Table 1 is that health subsidies have a positive impact on coverage. Figure 3 shows that, if the authorities reduce the co-payment for health services at state hospitals from the current 10 percent to zero, coverage would increase by 0.53 percentage points of the population over the age of 15. (In Chile, this would mean 58,600 more contributors as of August 2001).

However, using this policy tool to increase coverage is likely to reduce welfare. This is because the loss in terms of inefficient incentives in the demand for health services (requiring no co-payment leads to socially excessive utilization) and the efficiency loss imposed by the increase in tax rates required to pay for the additional fiscal expenditure probably outweigh the gains from this modest increase in coverage. On the contrary, it is likely that welfare would increase if the Chilean government brought co-payments back to their 1999 levels (20 percent and 50 percent for the two affected income groups), even though the coverage rate would fall slightly by 0.53 percentage points.
The Pension Fund Flat Commission Reduces Coverage

The fourth finding in Table 1 is that the flat commission (in real terms) charged by pension fund managers reduces coverage, because it increases the cost of participating in covered jobs for workers who do not expect to receive the Minimum Pension subsidy. The flat commission is by far the most well known and transparent of commissions in Chile, and the press and politicians have been raising the issue of its lack of equity repeatedly since 1981.

The level of the flat commission changed substantially during the sample period from Ch.$ 490 in 1990 to Ch.$ 133 in late 1996, where it hovered until - early 1998. Subsequently the flat commission rose in two separate steps) reaching Ch.$ 508 by August 2001.53 These two peaks are quite high relative to wages. In a 12-month cycle, they are equivalent to 6 percent of a monthly Minimum Salary. Recall that a worker earning the Minimum Salary also pays the wage-based commission at a rate of about 1.5 percent over and above the premium for disability and survivorship insurance. Thus, in a 12-month cycle, the two commissions add up to 24 percent of a monthly Minimum Salary.

Figure 4 shows that, if the flat commission had remained in its (high) level as of January 1990 until October 1997, the coverage rate at the latter date would have been smaller by 2.78 percentage points of the population over the age of 15. (This would have meant 290,300 fewer contributors as of October 1997). On the other hand, if the flat commission had remained in its (low) level as of October 1997 for the remainder of the sample period, the coverage rate at the end of the sample would have increased by 3.25 percentage points of the population over age 15. (This would have meant 361,400

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53 These numbers are adjusted for CPI inflation, in purchasing power of December 1998.
more contributors as of August 2001). Note that I minimized the size of this effect by choosing the (smaller) coefficients of the COVAFP equation over those from the COVTOT equation.

The influence of flat commissions on coverage should be proportional to the fraction of potential contributors who expect not to receive the Minimum Pension subsidy. The number of potential contributors in this situation includes a large portion the 1.6 million self-employed and an unknown proportion of the 5 million inactive people above the age of 15 who work at home. This is a large number of people, so the impact of flat commissions on coverage is likely to be substantial. I have defined flat commissions as a “policy” lever for two reasons. First, the authorities may choose to create a statutory cap on the flat commission charged by pension fund managers for equity reasons, as happens in several Latin American countries, which cap it at zero. Second, in some countries, the authorities influence the level of commissions by bargaining with a tight oligopoly of pension fund managers.

Figure 4: Coverage of AFP Plans that Cap the Flat Commission at the October 1997 Level

To those who mistakenly interpret the trend in coverage as a trend in economic activity, Figure 4 may seem to be suggesting that FLATCOM is capturing a break in the trend in economic growth. In fact, coverage stopped increasing later (in 1998) than economic activity (at the beginning of 1998). My regression already controls for per capita economic activity. In addition, FLATCOM fell to its low level as early as late 1996, and then rises back up in two definite steps, as can be seen in Appendix 2, so this variable has quite a different time path than per capita economic activity. Figure 4 should be interpreted as showing how much coverage was influenced by the two increases in FLATCOM after 1997.

Summary

These are the only four effects of economic policy that remain a part of the most parsimonious co-integrating vector among the long-run equations. Their impact is summarized in Table 3.
Table 3: Impact of Government Policy in Coverage in Chile

(As of August, 2001)

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed number of Contributors to AFP plan</td>
<td>3,334,631</td>
</tr>
<tr>
<td>Observed number of Contributors to INP plans</td>
<td>183,506</td>
</tr>
<tr>
<td>Total contributors for August 2001 (A):</td>
<td>3,518,137</td>
</tr>
<tr>
<td>Due to economic growth in the 1990s (B):</td>
<td>-198,300</td>
</tr>
<tr>
<td>Due to increase in health subsidies of Dec. 1999 (C):</td>
<td>-58,600</td>
</tr>
<tr>
<td>Total if these had not occurred (D = A-B-C):</td>
<td>3,261,237</td>
</tr>
<tr>
<td>By reducing minimum salary to February 1990 level (E):</td>
<td>+409,300</td>
</tr>
<tr>
<td>By reducing flat commission to October 1997 level (F):</td>
<td>+361,400</td>
</tr>
<tr>
<td>Total if these had occurred (G = A+E+F):</td>
<td>4,288,837</td>
</tr>
</tbody>
</table>

Table 3 shows that, in the 1990s, government policy could have increased the number of contributors from 3.3 million (line D) to 4.3 million (line G). I interpret this wide range (26 percent of the mean) as suggesting that coverage is governed by economic policy to a substantial extent.

Another way of presenting the policy implications is through a projection of coverage rates for Chile over the next 10 years under alternative scenarios. Figure 5 shows the impact over time of the following five scenarios:

- **PPPP0**: a growth in per capita economic activity of 0 percent, combined with a growth in the Minimum Salary of 2 percent (real) per year. The flat commission remains at the highest (real) level in the sample, and the payment for health treatment in state hospitals is set at the 1999 level (before it was reduced).
- **PPPP1**: same as PPPP0, but per capita economic activity grows at 4 percent (in real terms), and the political process responds by increasing the Minimum Salary by a rate of 5 percent (in real terms) per year. This political response mimicks the one that was observed in the 1990s.
- **PPPP2**: same as PPPP1, but the government allows a gradual reduction in the effective (real) Minimum Salary for vulnerable groups such as young workers to the 1990 level, phased in over five years.
- **PPPP3**: same as PPPP2, but the authorities negotiate or legislate a reduction of the flat commission charged by AFP plans to zero in one year.
- **PPPP4**: same as PPPP3, but co-payment for health treatment in state hospitals is reduced to zero in one year.
Figure 5: Coverage of AFP Plans for Alternative Policies in the Next Decade

Figure 5 confirms that there are two critical potential policy decisions for increasing coverage in Chile. The first would be to gradually reduce the effective Minimum Salary for vulnerable groups *despite rapid economic growth*. If economic growth is taken to be a good reason to keep on raising the Minimum Salary, then coverage will not increase. Recall also that reducing the Minimum Salary helps the poor both by increasing transfers to them and by increasing the efficiency of their labor decisions. The second key policy decision would be to cap the flat commission charged by AFP plans.
References


Appendix 1: Two Chilean Institutions: Assistance Pensions and Minimum Salary

The following provides a more detailed description of two Chilean institutions mentioned frequently in the text.

Assistance Pension: Eligibility and Targeting

This program (called PASIS) was created in 1975 by the Pinochet regime (Decree Law 869) and pays flat monthly pensions. The amount is set annually in the budget law and has fluctuated in between 8 percent and 15 percent of average taxable salaries. The PASIS program pays pensions to about 150,000 elderly people and to a similar number of disabled. In the 1990s, this program used up 2 percent of “social public expenditure” or 0.3 percent of GDP. The assistance pension is paid to all those over 65 years of age and to all disabled people between 18 and 64 years of age who meet the eligibility requirements. For the first issue of an old age PASIS, these requirements are:

(1) The recipient must be at least 65 years old.
(2) The recipient’s income must be below 50 percent of the current Guaranteed Minimum Pension (see text), whose size has fluctuated in the range between 20 percent and 30 percent of average taxable salaries. This requirement implies that no other pensions are compatible with PASIS.
(3) The average per capita income of the family, defined as the collection of people who live together on a permanent basis under the same roof, must be below 50 percent of the current Guaranteed Minimum Pension.
(4) The recipient must request the pension by writing to the municipality to obtain a favorable socioeconomic evaluation (from a social worker paid by the municipality) and to obtain an allocation from the Regional Government (it keeps a waiting list and allocates pensions on the basis of the relative poverty of those in the list). Once issued, the duration of the pension is unlimited provided that the recipient continues to meet the other requirements.
(5) The recipient must not stop drawing the pension for six or more consecutive months.

Requirement (4) includes the targeting stage. At this stage, the municipality sends a social worker to visit the claimant and qualifies her or his socioeconomic status by filling in the “ficha CAS 2.” This is a detailed questionnaire focusing on the quality of the claimant’s consumer durables such as housing, TV set, refrigerator, oven, music set, etc., which generates a score for the claimant. The allocation of pensions is done by the regional government, not by the municipality. Each regional government is led by an “Intendente,” who is a representative of the President of Chile but is not elected. The regional government organizes a single list of old age and disabled claimants, ordered by their scores on the questionnaire. The region has funds for a fixed number of pensions, and every month it allocates those freed up by recipients who cease to be eligible. At the national level, the annual budget law sets the total number of pensions and allocates them among the regions.

The targeting of this program was evaluated by the CASEN 94 survey, which found that 60 percent of the beneficiaries did not belong to the poorest quintile of households. In some regions, targeting is even worse. For example, in regions II and Metropolitan, only 30 percent of the beneficiaries belong to the poorest quintile of households, while 10 percent of the beneficiaries belonged to the richest two quintiles of households (ordered by average income per member), and 74 percent of beneficiaries had an income, including the PASIS, that was above the official poverty line.

A survey that asked beneficiaries about their own perception (EBEN) found that 42 percent of beneficiaries disagree with the notion that they received the pension because they were poor. The main reason mentioned by the beneficiaries was that she/he did not receive other pensions. To obtain this benefit, 57 percent of beneficiaries reported that, “it is useful to know someone in the municipality.” Only 7 percent believed that to obtain the pension, “it is enough to meet the eligibility requirements set by the municipality.” The survey showed also that 25 percent of beneficiaries do not meet requirements (2) or (3).

It was also found that there are a substantial number of people who meet the requirements to receive the old age assistance pension but do not in fact receive it. This number is 17 percent of actual recipients. Out of this number, 82 percent are below the poverty line.

The setting of the Minimum Salary from 1990 to 2001

The minimum wage is set in nominal terms and adjusted by law annually. It is reduced proportionally for part-time jobs. In the sample period, the method for determining its level followed an elaborate public ritual. In April of each year, anticipating Labor Day (May 1), the Ministers of Labor and Finance met the federation of Chilean labor unions in order to “negotiate” the coming increase. This negotiation was conducted in part through the press, as the governing coalition sought to assure voters about its concern for workers’ welfare. The main bones of contention were, at different times, the inflation adjustment, the “productivity” adjustment, and the “equity” adjustment, all of which needed to be balanced against the danger of igniting wage inflation. In his Labor Day speech, the President would announce a final number. This number was then included in a law proposal sent to Congress, while the union leaders made statements regretting the modesty of the increase. During May, Congress would approve the President’s proposal. No coalition would reduce the proposal and no one would increase it because, under the tough Chilean constitution, Congress does not have the legal authority to propose a larger increase. Finally, the law was enacted just in time for the adjustment to be applied to wages paid in June.

55 The Central Unica de Trabajadores (CUT). In some years, the employers’ union was invited as well, but subsequently they declined the offer.
56 The last two items are arbitrary, while the basis for the inflation adjustment was changed from past inflation rates to the expected inflation rate for the following 12 months. Further items for discussion have been exemptions from the minimum wage law for workers below the age of 21 and above the age of 65 and a reduced minimum wage for younger workers. A law of 1994 established that the minimum wage for home servants would be 75 percent of the national Minimum Salary, taking that wage level out of the annual negotiating exercise.
57 The impact on employment is routinely dismissed by the center-left parties and emphasized by the opposition center-right parties.
Appendix 2: Graphs of the Data and Stationarity Tests for all the Variables

The variables are grouped in the same way they were presented in the main text.

The Dependent Variable (COV)

**COVAEP: the coverage rate of the AFP plans with the longer sample.**

An augmented Dickey-Fuller test found that it is not possible to reject the null hypothesis that COVAEP is I(1) (see table below).

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.54896</td>
<td>-4.0273</td>
<td>-3.4430</td>
<td>-3.1460</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

**Augmented Dickey-Fuller Test Equation**

Dependent Variable: D(AFP)

Method: Least Squares

Date: 02/14/02   Time: 19:55

Sample(adjusted): 1990:06 2001:10

Included observations: 137 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>COV(-1)</td>
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<td>0.057549</td>
<td>-1.548968</td>
<td>0.1238</td>
</tr>
<tr>
<td>D(COV(-1))</td>
<td>-0.44082</td>
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<td>0.0000</td>
</tr>
<tr>
<td>D(COV(-2))</td>
<td>-0.38374</td>
<td>0.102673</td>
<td>-3.737547</td>
<td>0.0003</td>
</tr>
<tr>
<td>D(COV(-3))</td>
<td>-0.16509</td>
<td>0.099455</td>
<td>-1.659980</td>
<td>0.0993</td>
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<tr>
<td>D(COV(-4))</td>
<td>-0.01897</td>
<td>0.089200</td>
<td>-0.212694</td>
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<tr>
<td>C</td>
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<td>0.015024</td>
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<td>0.1009</td>
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<tr>
<td>@TREND</td>
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<td>2.59E-05</td>
<td>0.774571</td>
<td>0.4400</td>
</tr>
</tbody>
</table>

This result does not change if the trend and non-significant lags are removed from the test equation. When I ran tests for some subsamples of the time period, such as the subsample starting in 1995, the results were different. This fact suggests that COVAEP is a stationary variable with one or more structural changes. In my regression, I tried to explain these apparent structural breaks with the economic and policy variables that I identified in Parts III and IV. For example, the 1998 break may have been caused by a reduction in the growth rate of per capita economic activity in early 1998 or by the increase in the Minimum Salary or by the increase in flat commissions, although the latter rose in two distinct stages.

In order to use the full sample, it was necessary to interpret COVAEP as I(1). The alternative was to statistically identify any structural breaks that did not have a clear economic justification. Given that I did control for changes in economic and policy variables, I chose the full sample with the I(1) interpretation.

**COVTOT: the coverage rate for the full second pillar, including both the AFP and INP plans, with the shorter sample, starting in April 1995.**

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2.060250</td>
<td>-3.5164</td>
<td>-2.8991</td>
<td>-2.5865</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.
An augmented Dickey-Fuller test found that the null hypothesis of no stationarity could not be rejected. This was the same result that I found for COVAFP in similar subsamples.

Policy Variables

The values of these variables depend on policy decisions. Therefore, there are no reasons to expect any reversion to a mean or trend. For this reason, strictly speaking I did not need to make a test to decide whether or not to include them. However, I did perform the tests and found that all of the variables that remained in the preferred model are I(1).

*Per capita economic activity (ECACTIV):*

This is a policy variable in the sense that macroeconomic policy can influence economic activity and that microeconomic reform policies can increase growth.

The null hypothesis of non-stationarity could not be rejected for ECACTIV. Note that per capita economic activity presents an apparent structural break – a reduction in the growth rate of economic activity – in early 1998.

*Real minimum salary (MINSAL):*

This table shows that the null hypothesis of non-stationarity could not be rejected. As this variable is seasonal, I also performed a Dickey-Hazsa–Fuller Test for unit root that takes seasonality into account. In this case, the result was even more conclusive, because the critical value at 5 percent was -2.02 and the test statistics was 1.5338, much higher than that (see below).
Dependent Variable: MINSAL-MINSAL(-12)
Method: Least Squares

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1788.519</td>
<td>1323.674</td>
<td>1.351178</td>
<td>0.1788</td>
</tr>
<tr>
<td>MINSAL(-12)</td>
<td>0.029381</td>
<td>0.019155</td>
<td>1.533841</td>
<td>0.1273</td>
</tr>
</tbody>
</table>

Minimum Pension (MINPEN):

ADF Test Statistic  -1.651103  1% Critical Value*  -3.4789
5% Critical Value  -2.8825
10% Critical Value -2.5778
*MacKinnon critical values for rejection of hypothesis of a unit root.

The null hypothesis of non-stationarity could not be rejected for MINPEN.

Flat commission (FLATCOM):

This variable is averaged across all the individual AFP and set in real terms.

ADF Test Statistic  -1.11021  1% Critical Value*  -3.4811
5% Critical Value  -2.8835
10% Critical Value -2.5783
*MacKinnon critical values for rejection of hypothesis of a unit root.

The null hypothesis of non-stationarity could not be rejected for FLATCOM. Note that FLATCOM achieved its minimum by the end of 1996, and then again in early 1998. Subsequently it rose in two stages. This two-step increase is quite different from the one-time reduction in the growth rate of per-capita economic activity, so the regression allows the data to differentiate between the two effects.

Waged-based AFP commission (WCOMW):

This variable is a peso amount. I calculated it as the product of the wage-based commission rate (the average of commission rates of the individual AFP fund
managers), times the Minimum Salary amount in real terms. As the Minimum Salary is a policy variable, WCOMW belongs to the set of policy variables.

The null hypothesis of non-stationarity of WCOMW could be rejected at the 5 percent level.

*The ratio of the Minimum Pension to Average salary (COLL):*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.000730</td>
<td>0.000793</td>
<td>0.920636</td>
</tr>
<tr>
<td>PROB(-1)</td>
<td>-0.103781</td>
<td>0.030412</td>
<td>-3.41559</td>
</tr>
<tr>
<td>DU</td>
<td>-0.038414</td>
<td>0.004468</td>
<td>-8.597086</td>
</tr>
<tr>
<td>D(PROB(-1))</td>
<td>-0.219058</td>
<td>0.071074</td>
<td>-3.082109</td>
</tr>
<tr>
<td>D(PROB(-2))</td>
<td>-0.137998</td>
<td>0.069197</td>
<td>-1.994268</td>
</tr>
</tbody>
</table>

The null hypothesis of non-stationarity could be rejected at the 10 percent significance level.

*The ratio between the number of transfers between fund management companies and the number of contributors (CHURNING):*

By performing a test with a structural change in February 1998, I found that this variable is stationary.

*Payment for health services in state hospitals (HEALTH):*
This variable exhibits an obvious structural change (see figure). It was unnecessary to do a unit root test to establish that this is a stationary variable.

Severance cost, as measured by the Heckman and Pagés index (SEVERANCE):

Within our sample (the shaded part is used in our regression), this variable also exhibits an obvious structural change, so it is a stationary variable. The figure shows a longer series than the one that I used in the regression.

Average age of contributors (AGE):

This is not a policy variable, but I include it in this review because it is not stationary. Even though in the very long term this variable should be stationary, in our sample it behaved in a non-stationary way, as shown by the ADF test.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2.845161</td>
<td>-4.0263</td>
<td>-3.4426</td>
<td>-3.1457</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.
Non-policy Stationary Variables

The following variables are not chosen by policymakers, and the existence of a unit root is rejected for them.

**Phase of the business cycle (PHASE):**

![Phase of the business cycle](image1)

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.352351</td>
<td>-2.5805</td>
<td>-1.9422</td>
<td>-1.6169</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

**Uncertainty about the continuity of the AFP system (UNCERTAIN):**

By construction, this variable has no stochastic component or trend.

![Uncertainty about the continuity of the AFP system](image2)

**The Share of AFP plan contributors in total contributors including INP plans (SHARE):**

![The Share of AFP plan contributors in total contributors including INP plans](image3)

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2.951542</td>
<td>-3.4796</td>
<td>-2.8828</td>
<td>-2.5780</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

The test showed that this is a stationary variable.
Financial return of pension funds minus the interest rate on bank deposits: This variable is averaged across all individual AFP plans.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.104755</td>
<td>-3.4826</td>
<td>-2.8842</td>
<td>-2.5787</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

The test showed that this is a stationary variable.
Appendix 3: Cointegrating Vectors for Long-run Equation before Reduction

All policy and no stationary variables are included. (Final variables are shaded.)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.494904</td>
<td>0.147627</td>
<td>-3.352393</td>
<td>0.0010</td>
</tr>
<tr>
<td>ECACTIV</td>
<td>2147.302</td>
<td>749.4887</td>
<td>2.865023</td>
<td>0.0049</td>
</tr>
<tr>
<td>MINSAL</td>
<td>-7.63E-07</td>
<td>3.27E-07</td>
<td>-2.334085</td>
<td>0.0211</td>
</tr>
<tr>
<td>AGE</td>
<td>0.023732</td>
<td>0.004702</td>
<td>5.047160</td>
<td>0.0000</td>
</tr>
<tr>
<td>HEALTH</td>
<td>-0.000435</td>
<td>0.000318</td>
<td>-1.369902</td>
<td>0.1731</td>
</tr>
<tr>
<td>FLATCOM</td>
<td>-7.73E-05</td>
<td>1.39E-05</td>
<td>-5.555223</td>
<td>0.0000</td>
</tr>
<tr>
<td>WCOMW</td>
<td>1.39E-05</td>
<td>1.06E-05</td>
<td>0.131348</td>
<td>0.8957</td>
</tr>
<tr>
<td>SEVERANCE</td>
<td>0.002481</td>
<td>0.005097</td>
<td>0.486690</td>
<td>0.6273</td>
</tr>
<tr>
<td>MINPEN</td>
<td>-2.82E-07</td>
<td>2.45E-07</td>
<td>-1.152021</td>
<td>0.2514</td>
</tr>
</tbody>
</table>

R-squared 0.902636  Mean dependent var 0.286905  
Adjusted R-squared 0.896690  S.D. dependent var 0.018814  
S.E. of regression 0.006047  Akaike info criterion -7.316355  
Sum squared resid 0.004790  Schwarz criterion -7.127249  
Log likelihood 521.1448  F-statistic 151.8087  
Durbin-Watson stat 1.431725  Prob(F-statistic) 0.000000